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PIPES AND PIPEWORK

# Manufacturing Chemist

*incorporating*

*MANUFACTURING PERFUMER*

Vol. XXIX No. 9 A PUBLICATION OF THE LEONARD HILL TECHNICAL GROUP SEPTEMBER, 1958

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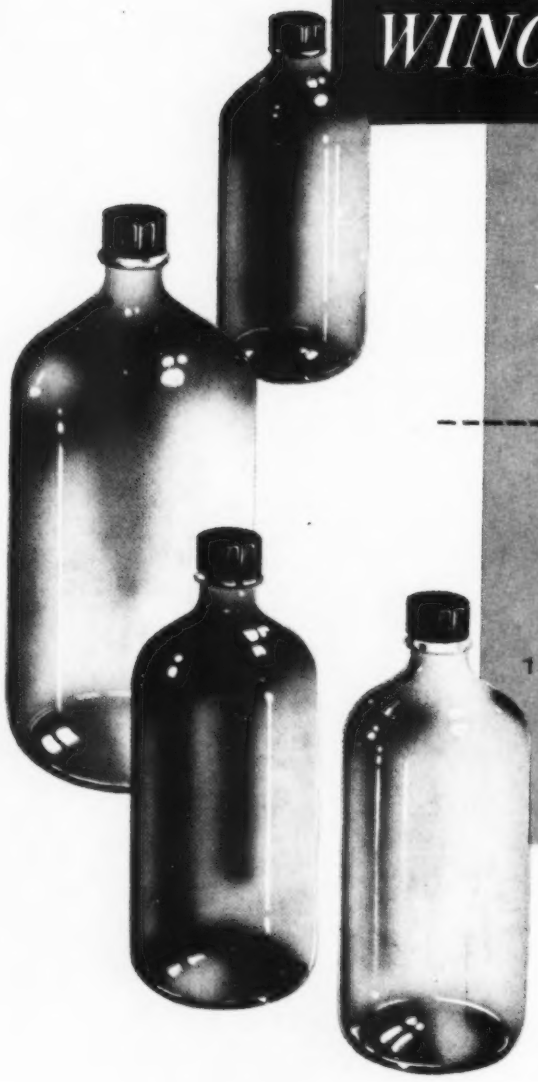

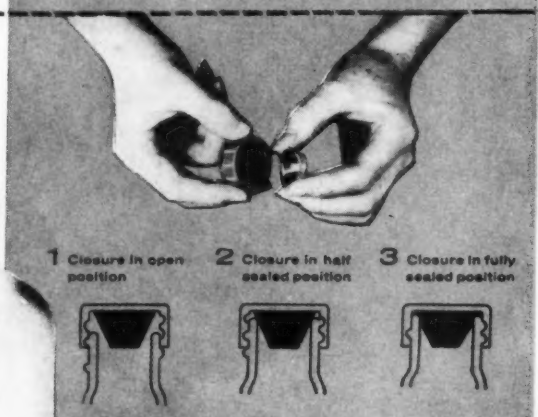


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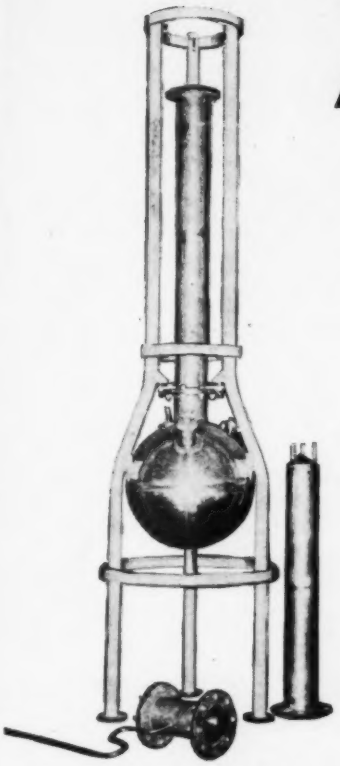

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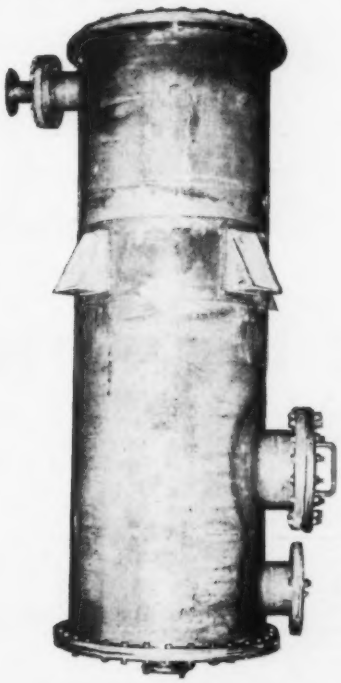

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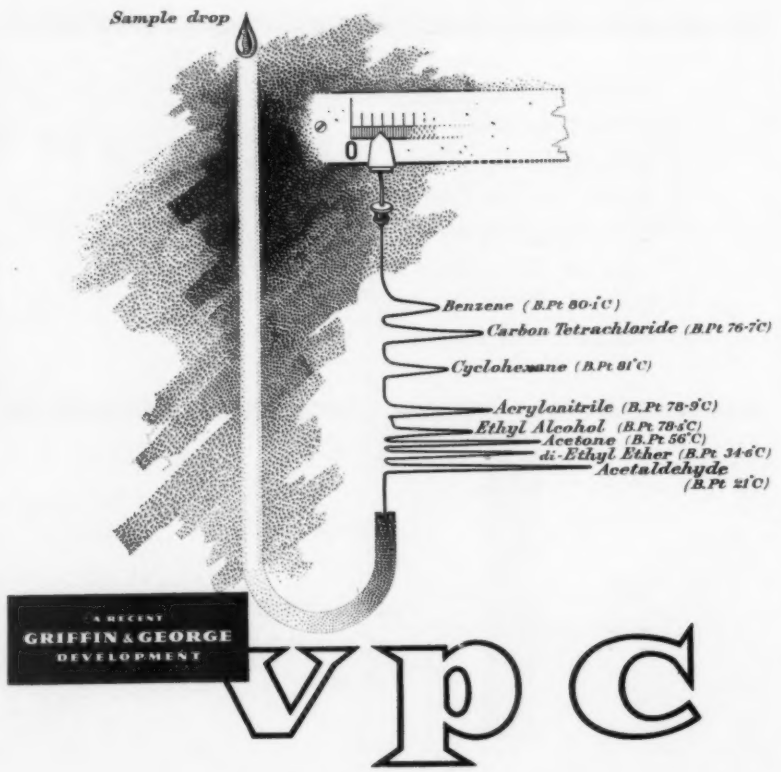


***A company and its Chairman celebrate their ....***

# GOLDEN JUBILEE

This year Mr. J. Arthur Reavell, M.I.Mech.E., M.I.Chem.E., F.Inst.F., F.I.M., celebrates his fiftieth year as Chairman of the Company he founded, The Kestner Evaporator and Engineering Company Limited. Although now 86, he is found in his office on most days of the week and annually visits his overseas branches.

The company came into being because Mr. Reavell's great friend, the famous French physicist, Paul Kestner, wished him to take over the Empire rights of the evaporator and other Kestner patents. Since then, he has added a long string of his own patents. Today, there is scarcely an industry in which Kestner plant is not used. For Kestner have always been the pioneers in design, adapting new materials to new processes, and from still newer processes evolving still newer materials.

Perhaps their greatest contribution has been in the field of corrosion, which has become an increasingly complex problem as modern industry has expanded and developed. Continuing and intensive research has produced the famous range of Keebush acid and alkali resistant resins: of silicon irons to combat acid erosion: of acid elevators and fans for acid gases: of the new Keeglas, an adaptation of resin impregnated glass fibre.

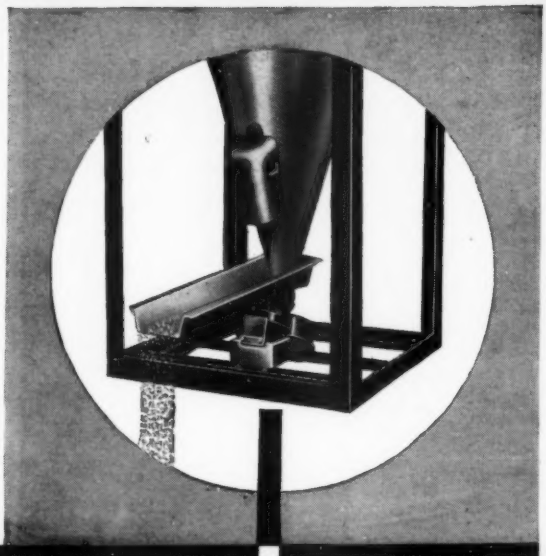
As Mr. Reavell says, 'I have lived a full life and intend to go on doing so'. And it is the sincerest wish of his colleagues and employees that he may long be spared to inspire them to maintain and enlarge the high reputation in chemical engineering that has been held by Kestner for half a century.

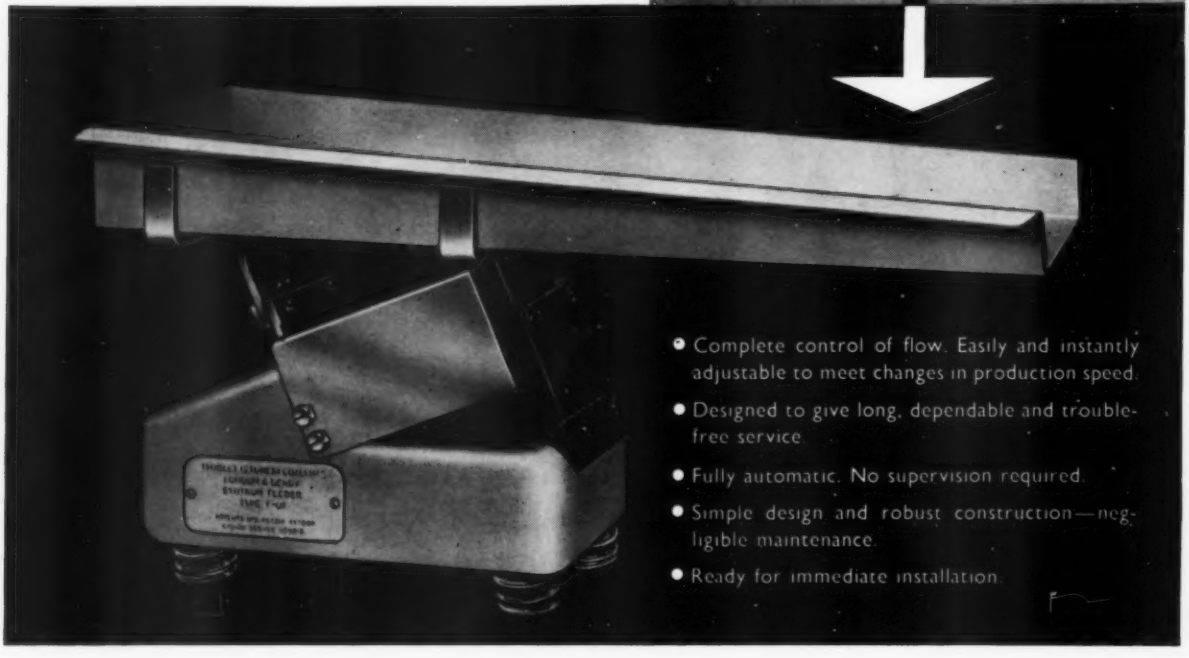
**Kestner**
THE CHEMICAL ENGINEERS

KESTNER EVAPORATOR & ENGINEERING CO LTD 5 GROSVENOR GARDENS LONDON SW1

# Bulk materials flow smoothly at a controlled rate

Model FO-1 feeder controls the flow of materials from the merest trickle up to 2 tons per hour. It eliminates the possibility of work stoppages or slow downs due to over-feeding or underfeeding. Compact and easily adapted to many functions, this model is widely used to deliver materials to automatic weighing machines, where steady feeding is essential.





- Complete control of flow. Easily and instantly adjustable to meet changes in production speed.
- Designed to give long, dependable and trouble-free service.
- Fully automatic. No supervision required.
- Simple design and robust construction—negligible maintenance.
- Ready for immediate installation.

# SYNTRON *KEEPS THINGS MOVING*

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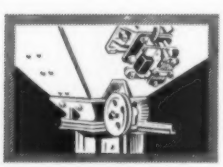
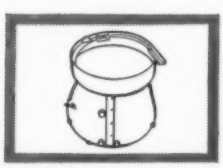
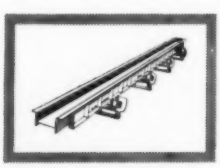
RILEY (IC) PRODUCTS LIMITED, ONE OF THE INTERNATIONAL COMBUSTION GROUP OF COMPANIES
NINETEEN WOBURN PLACE, LONDON W.C.1. TELEPHONE TERMINUS 2622



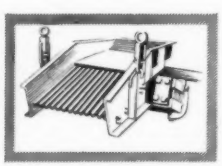
**Syntron Electric Vibrators** keep bins, hoppers and chutes clear with adjustable electro-magnetic vibration.



**Bowl Feeders** for orientating and feeding of small components, bottle caps, tablets, nuts, bolts etc.



**Syntron Trough Feeders** for use where materials must be carried over distances.



**Syntron Heavy Tonnage Feeders** are robust units capable of handling up to 750 tons per hour.

**Syntron Packers** provide a fast and efficient means of compacting and settling products in containers.

TGA 557

a-amyl cinnamic aldehyde

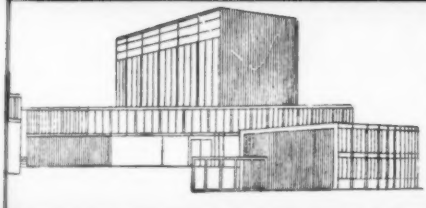
styralyl acetate

phenylacetaldehyde dimethylacetal

hydroxycitronellal

hydratropic aldehyde

citrals



Polak & Schwarz's new chemical factory recently opened at Haverhill, Suffolk The P. & S. organisation, which now has 18 associated companies throughout the world has, during the last 69 years, attained wide experience in the field of aromatic chemicals.

**POLAK & SCHWARZ (ENGLAND) LTD.**

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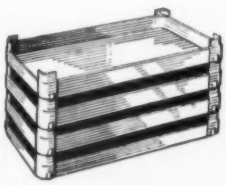

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| Product | high viscosity water in oil emulsion |
| Throughput | 300 gallons per hour |
| Power | 2 hp maximum |
| Location | wooden floor with weight limit |
| Labour | only unskilled available |
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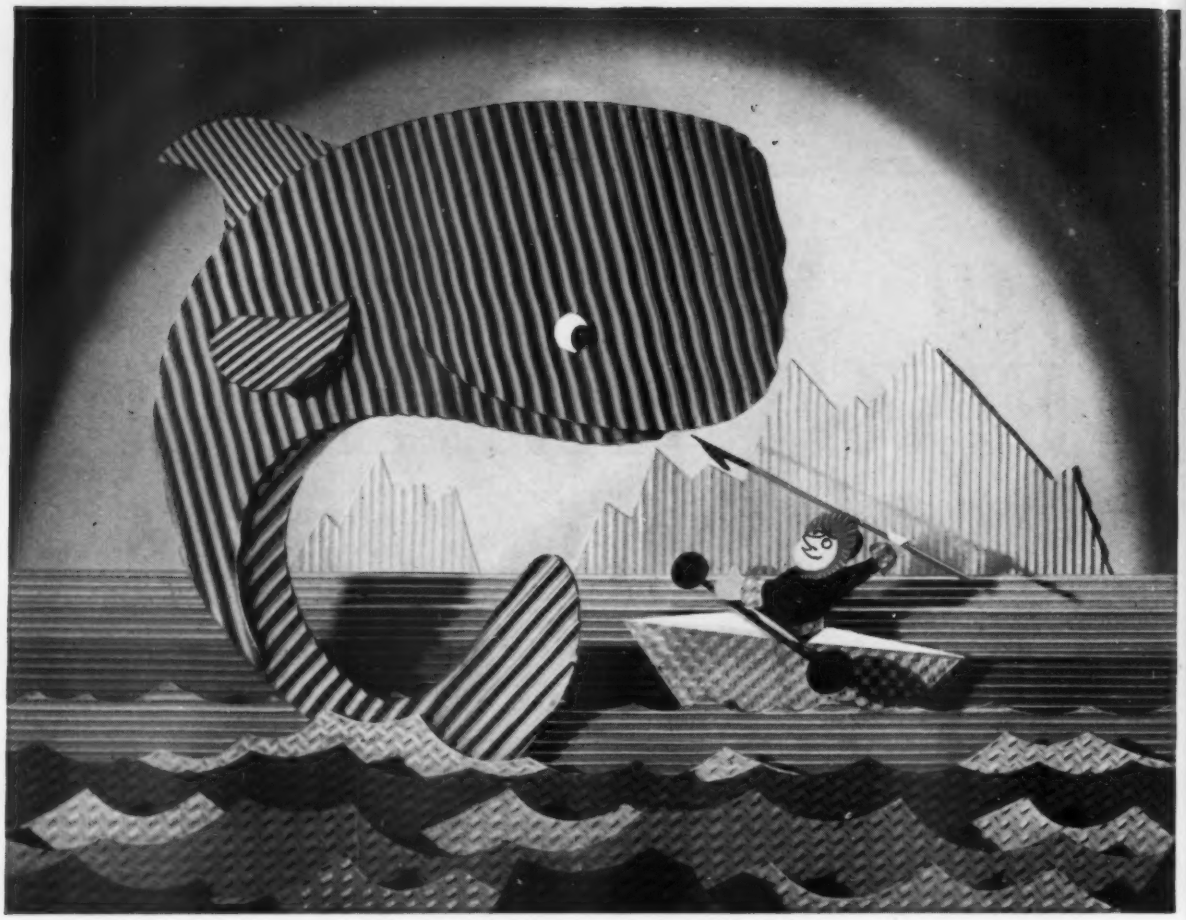

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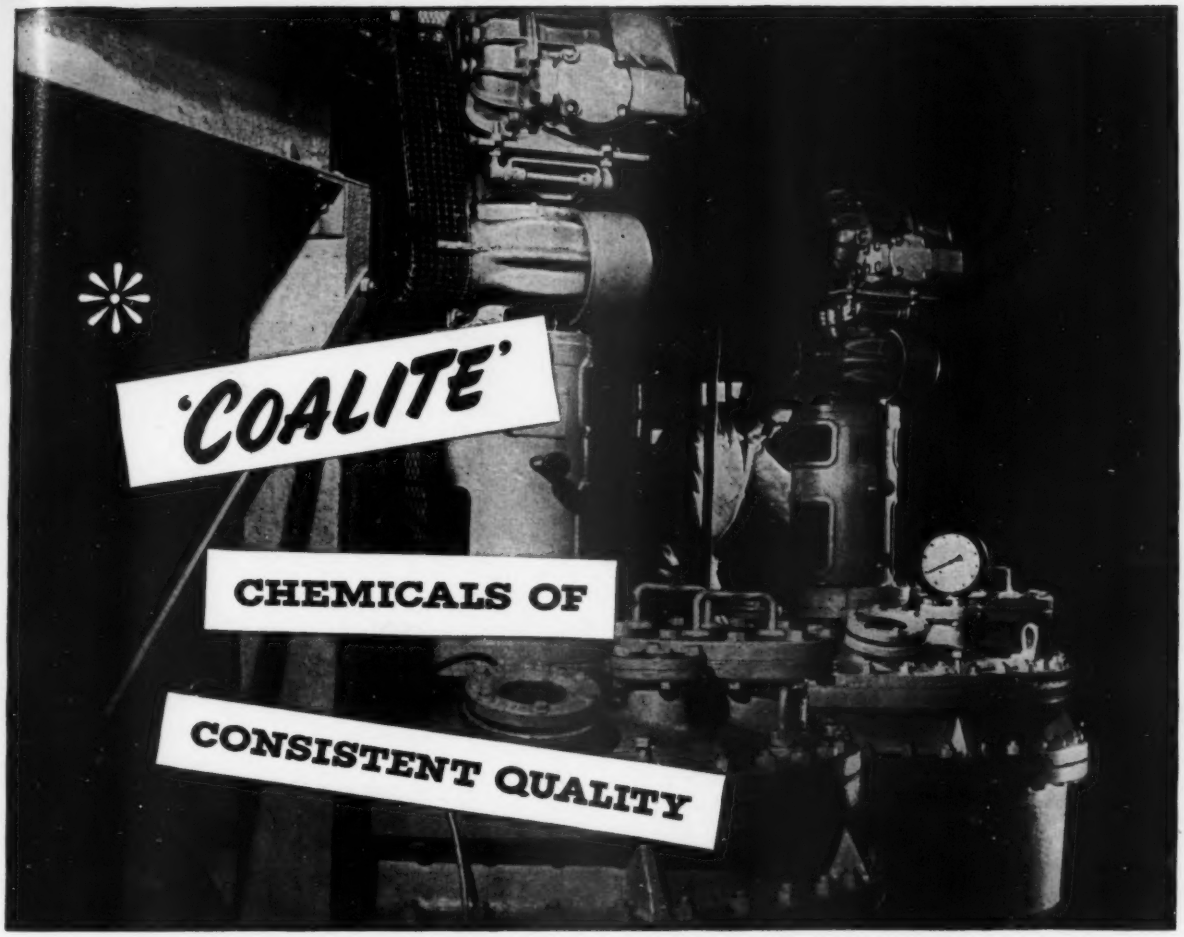


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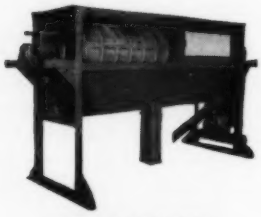

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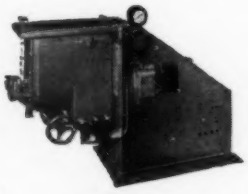

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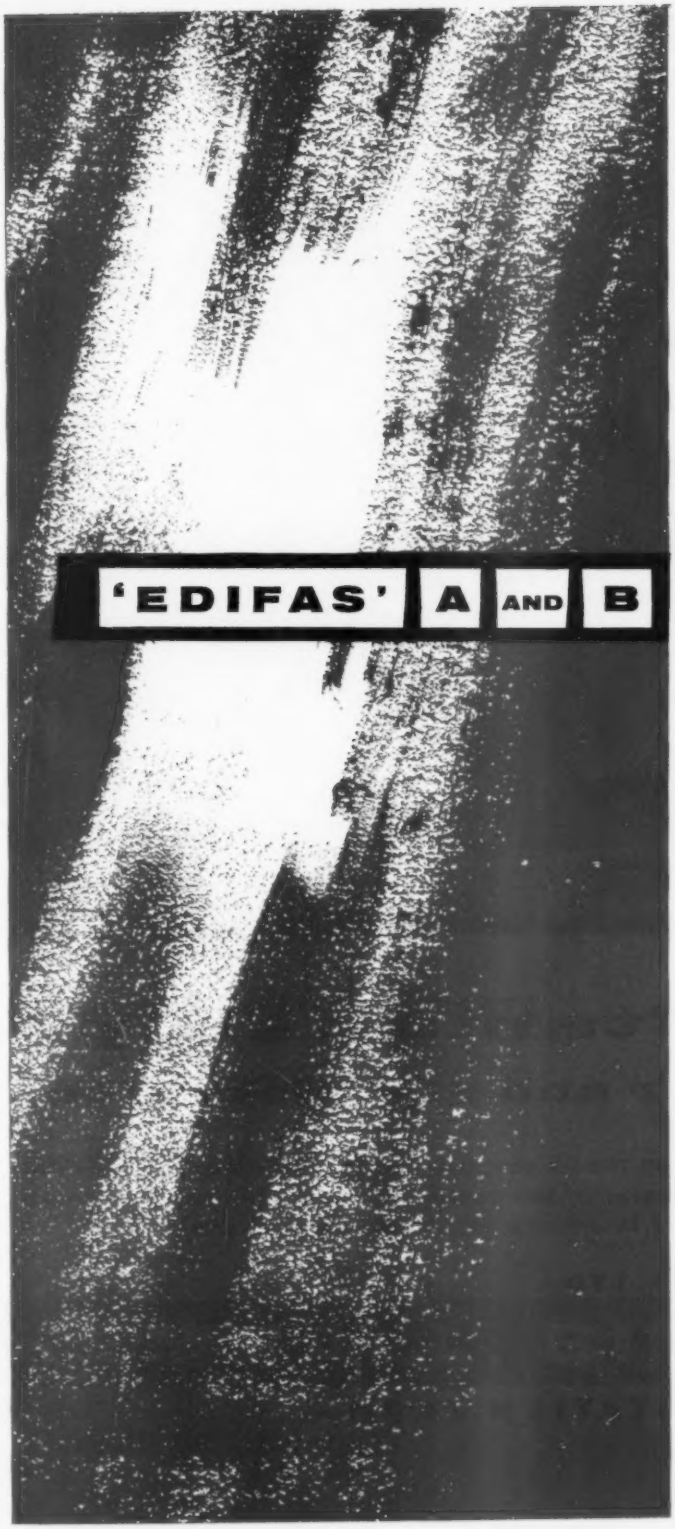


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NC. 4

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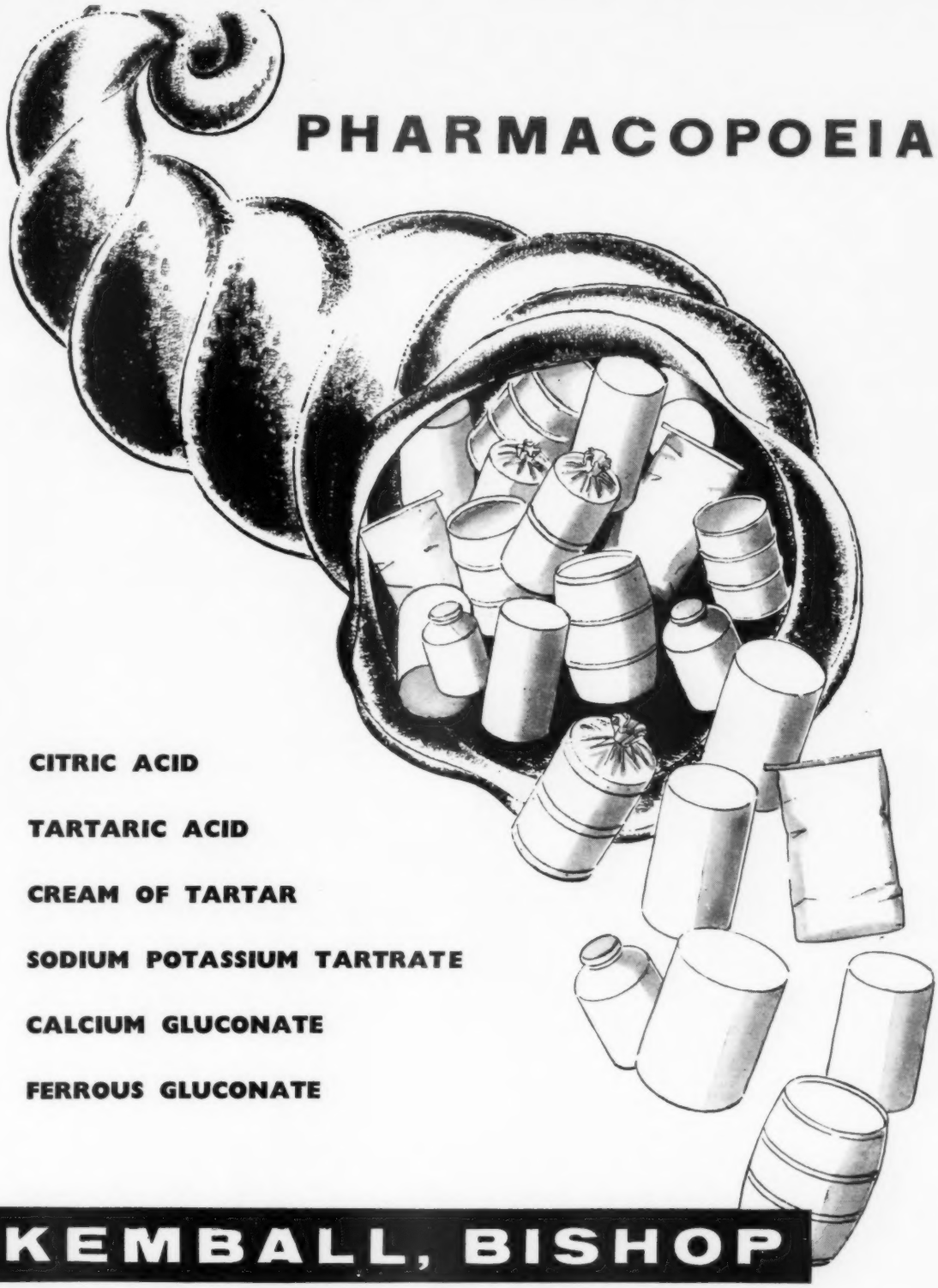

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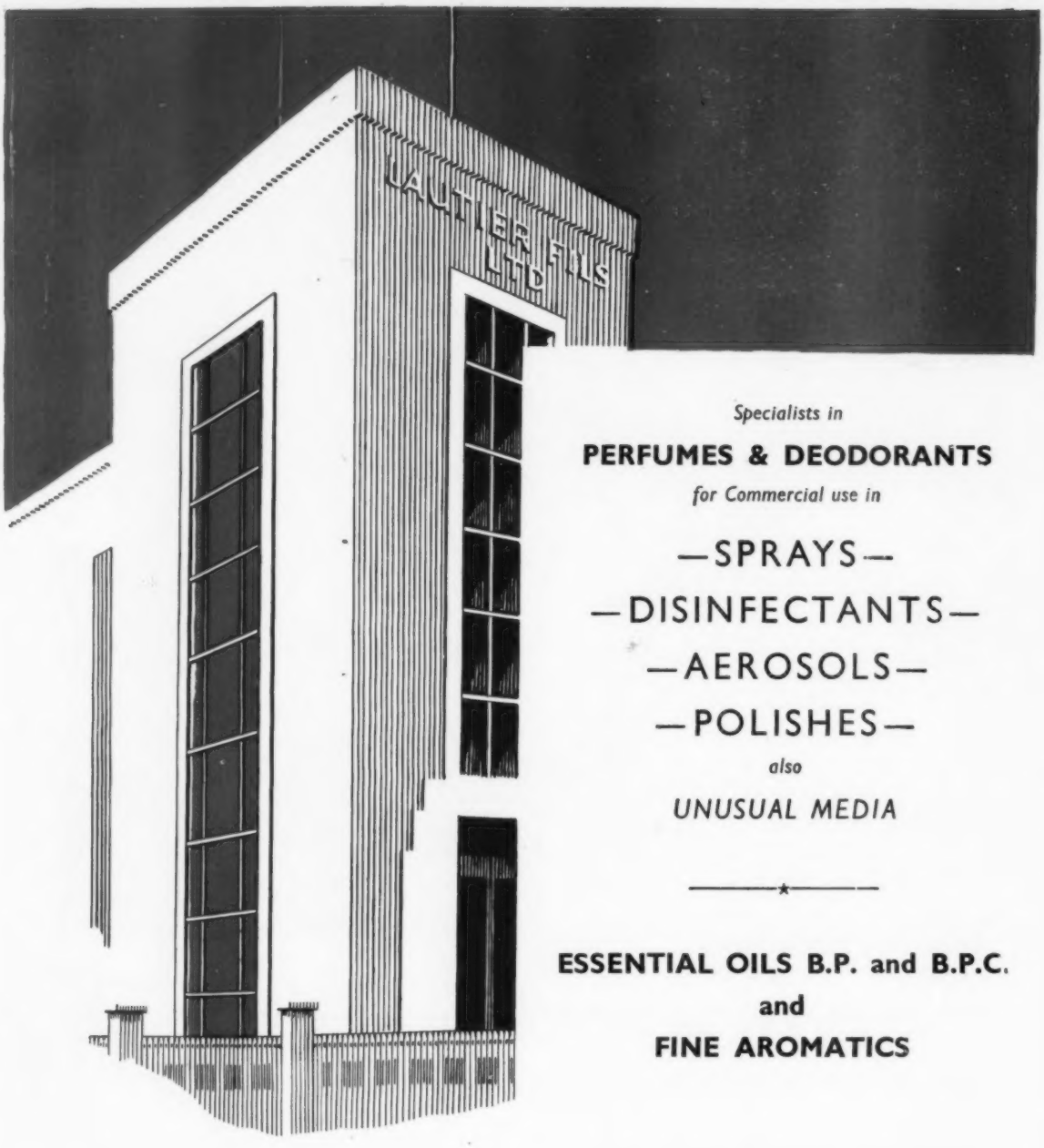


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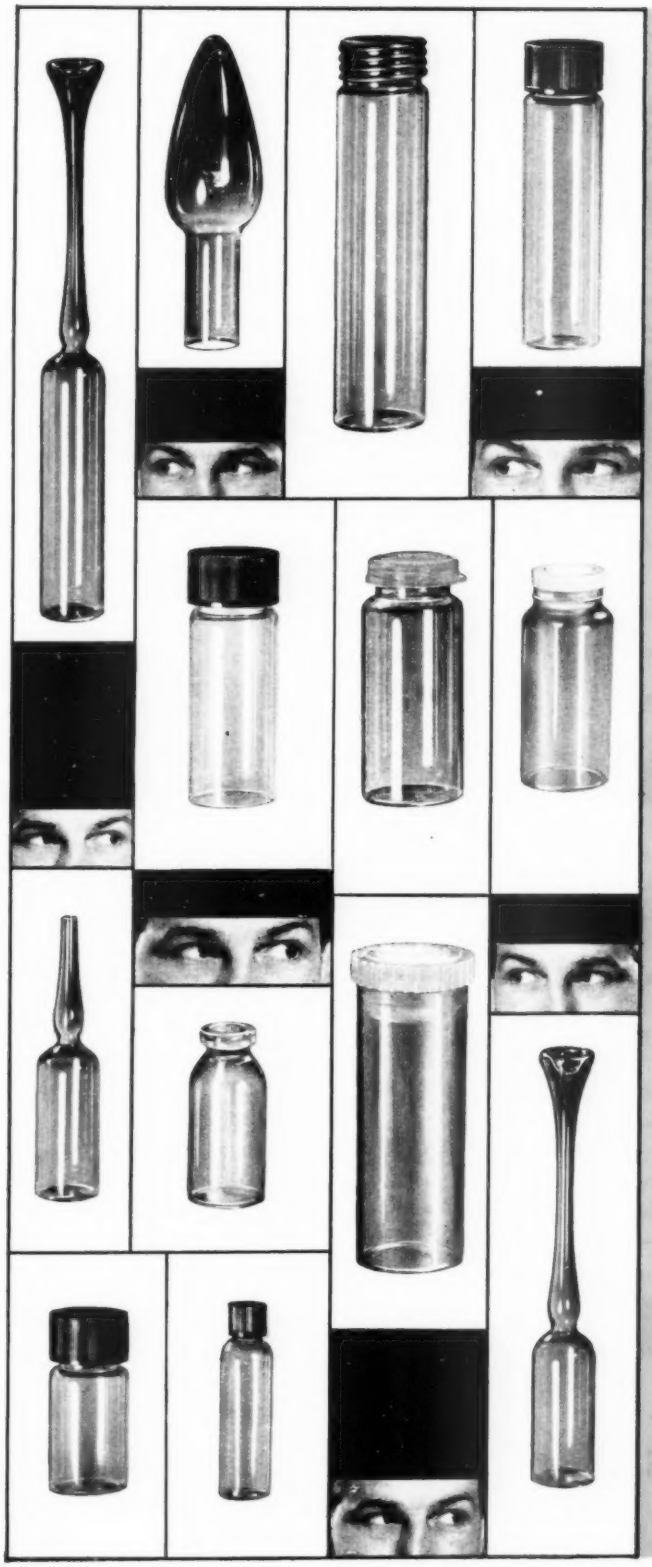

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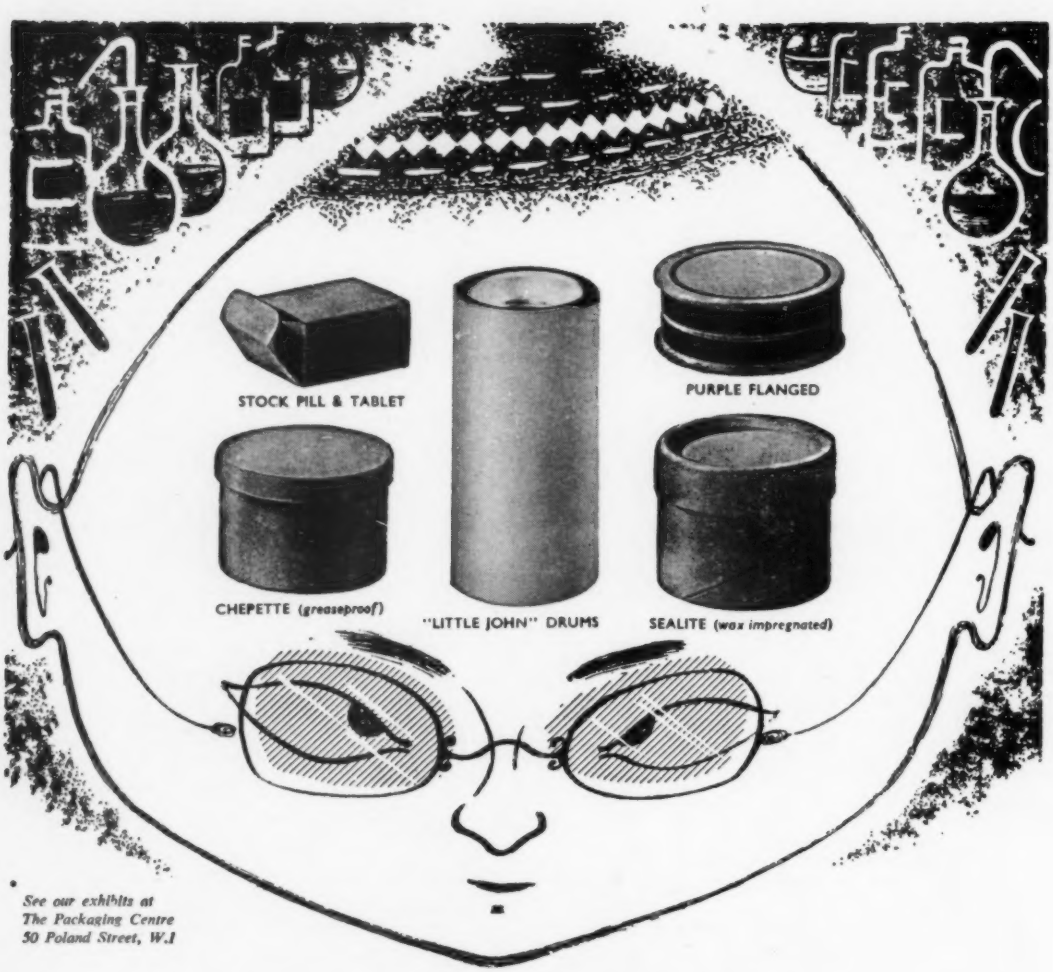


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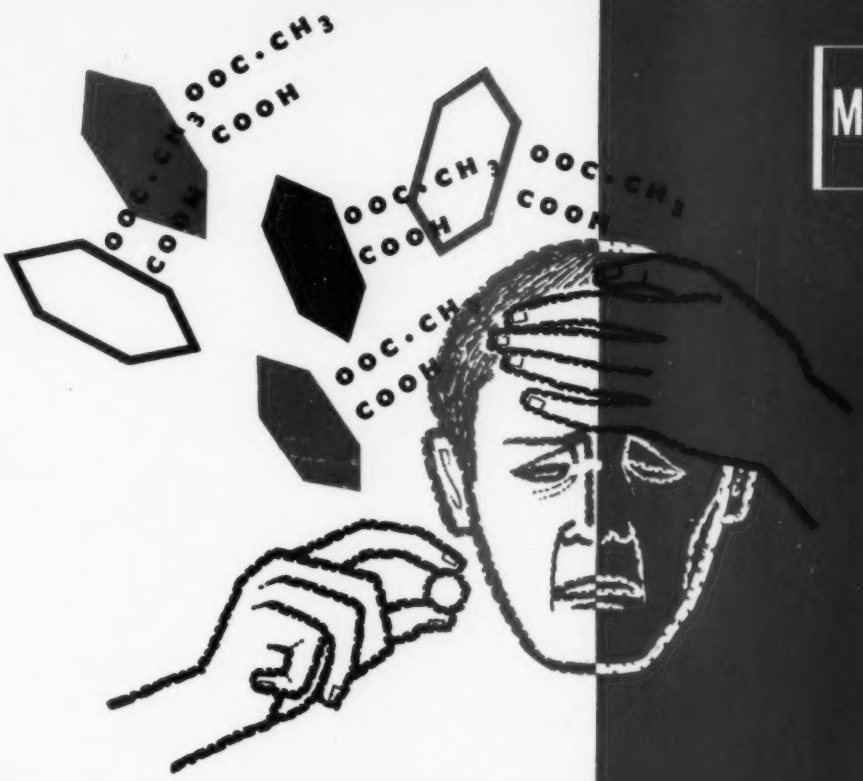


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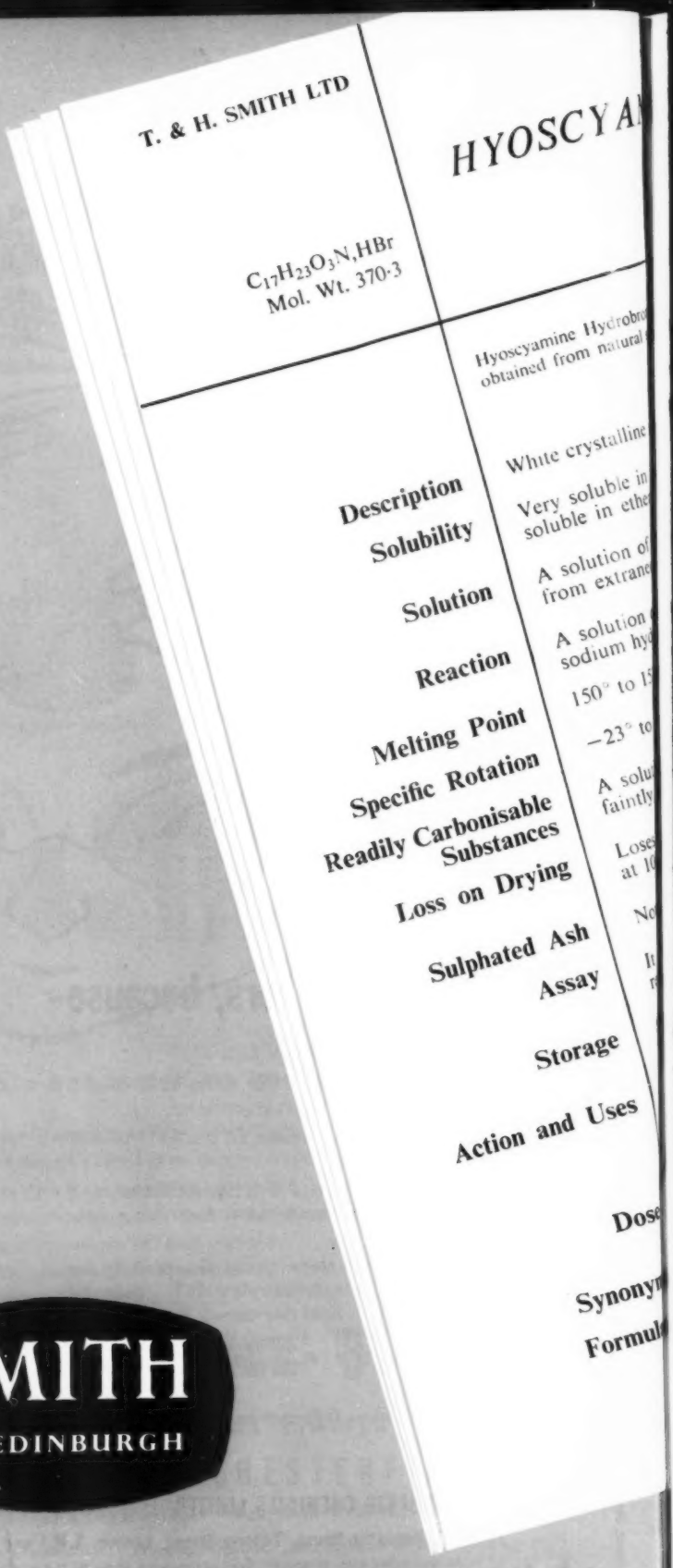


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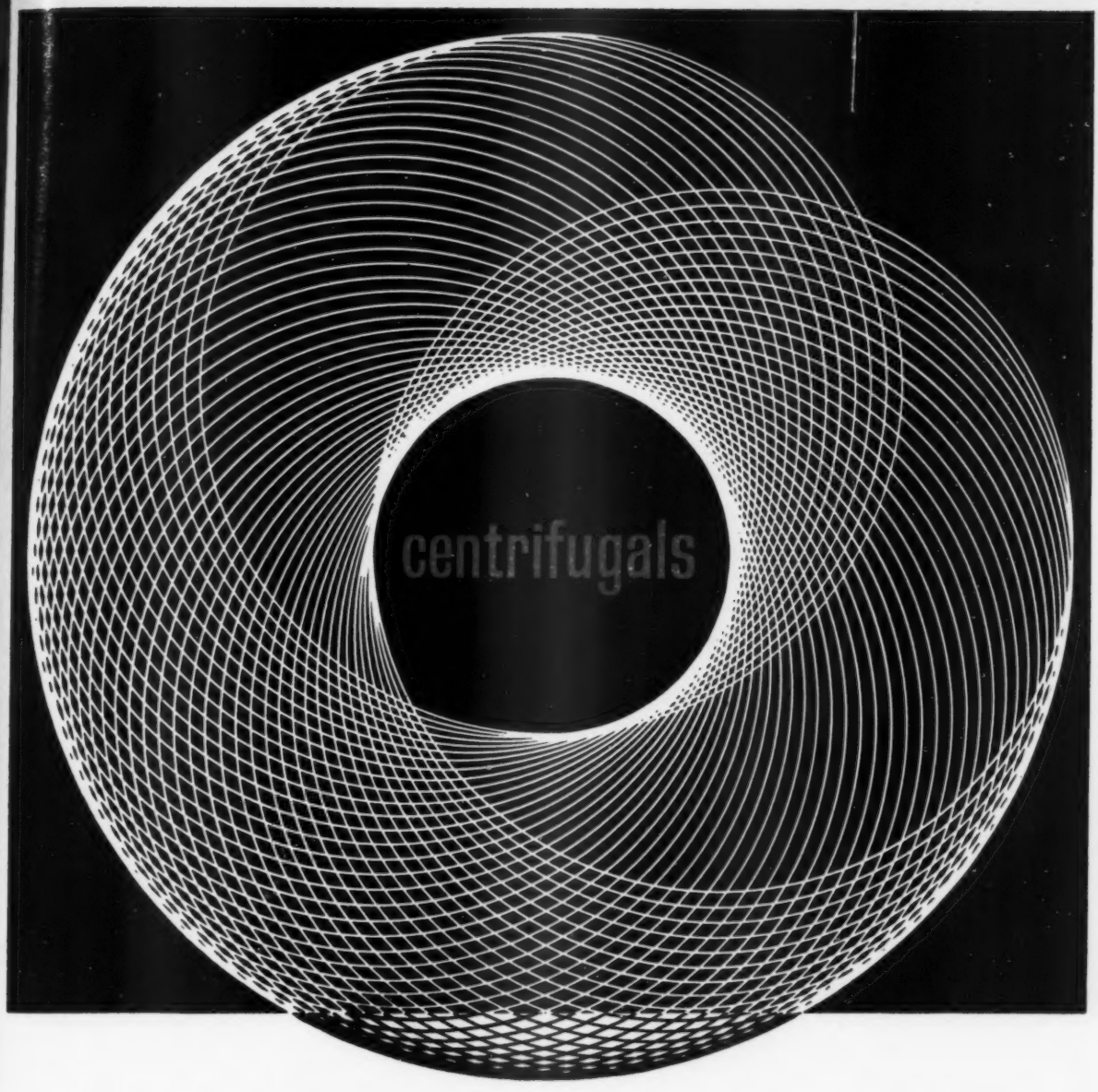


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GC. 11

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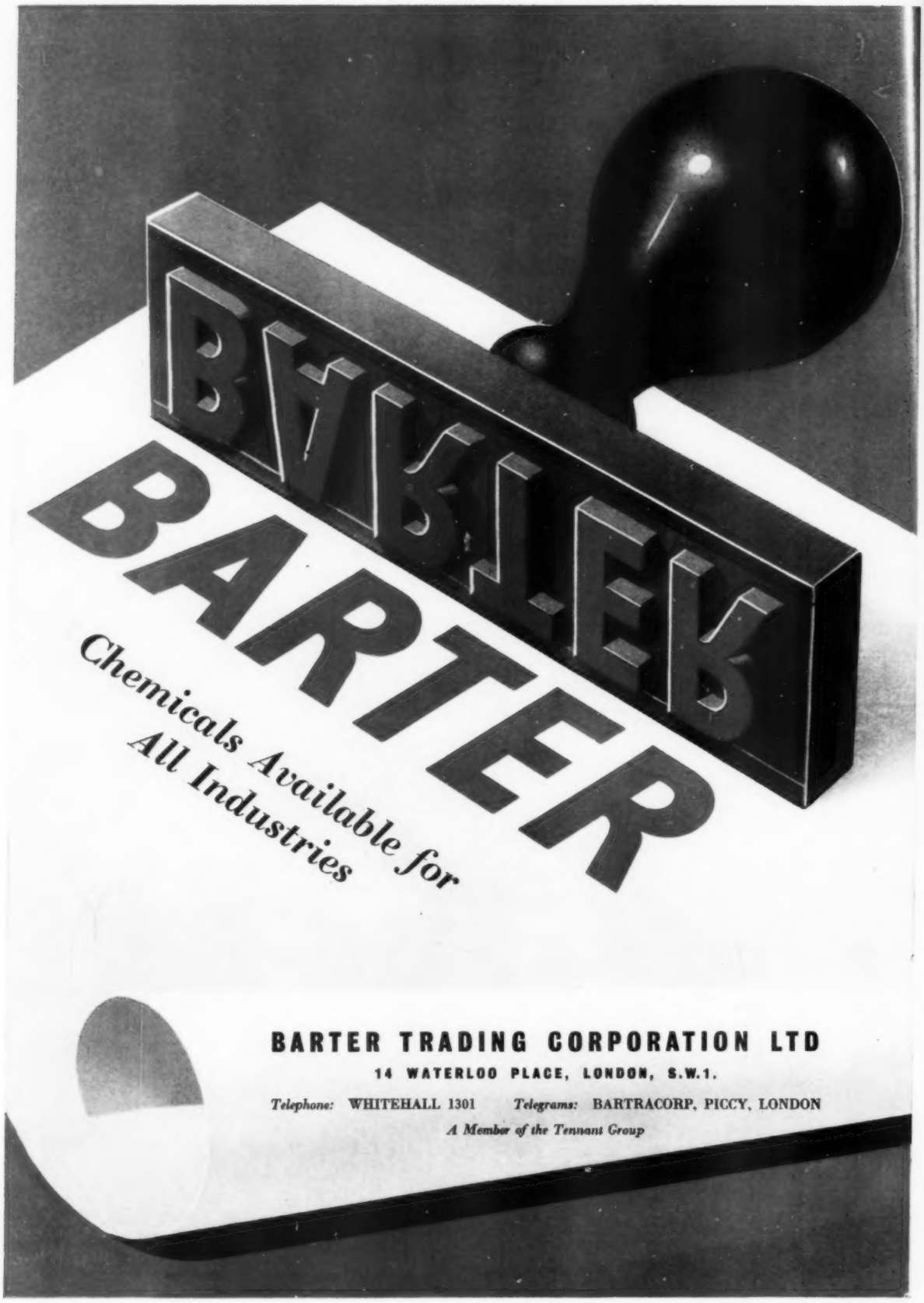
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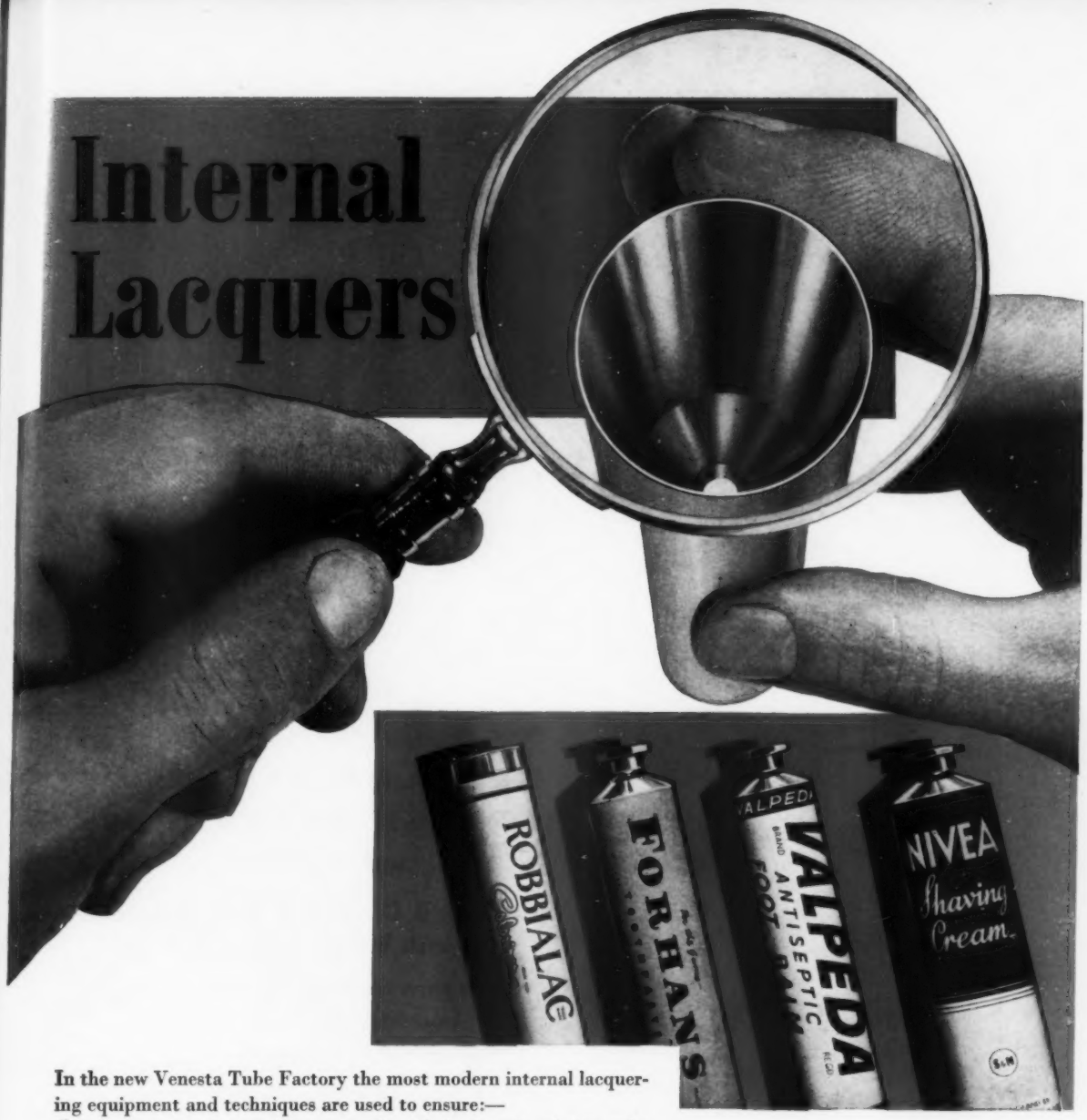


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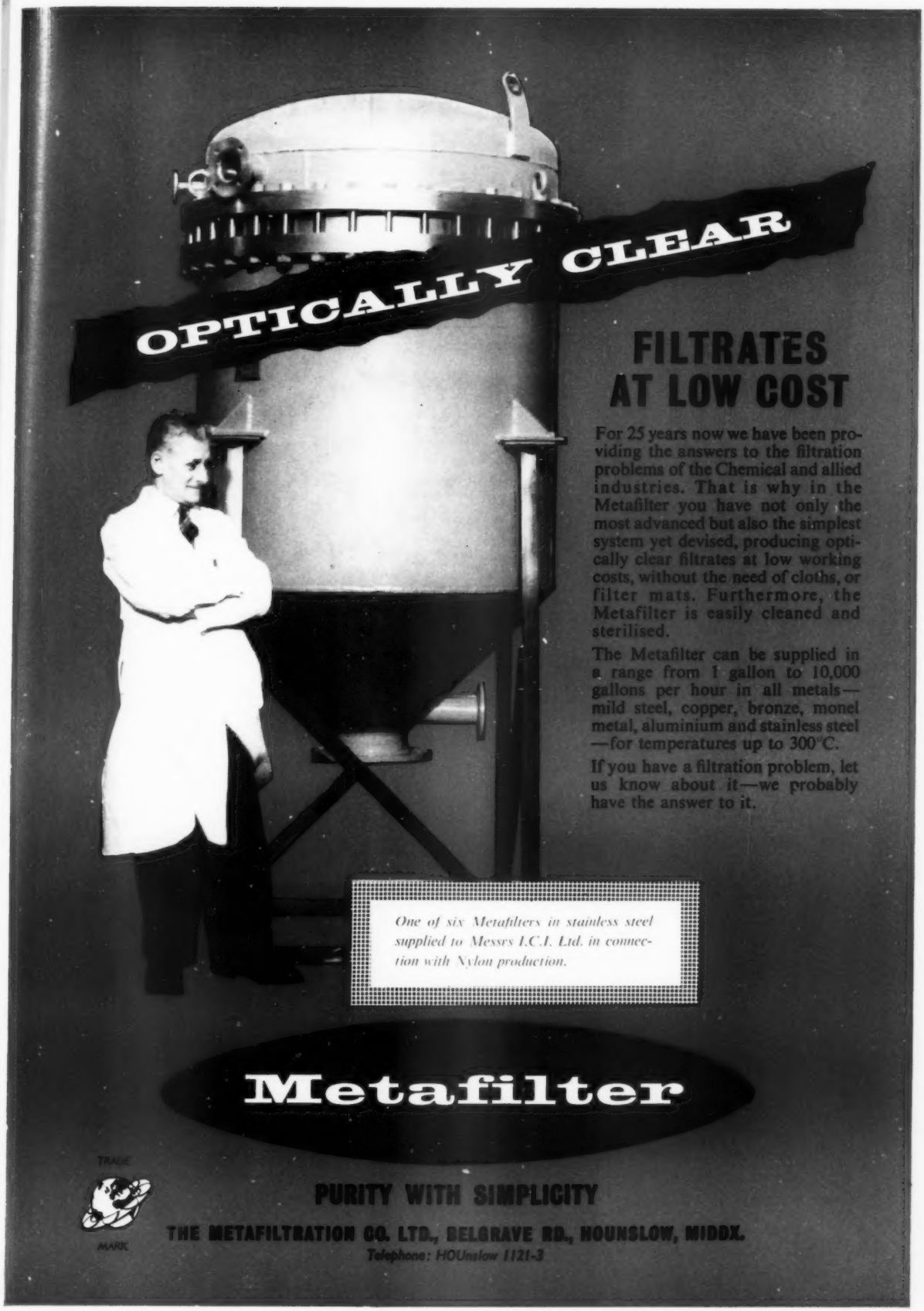


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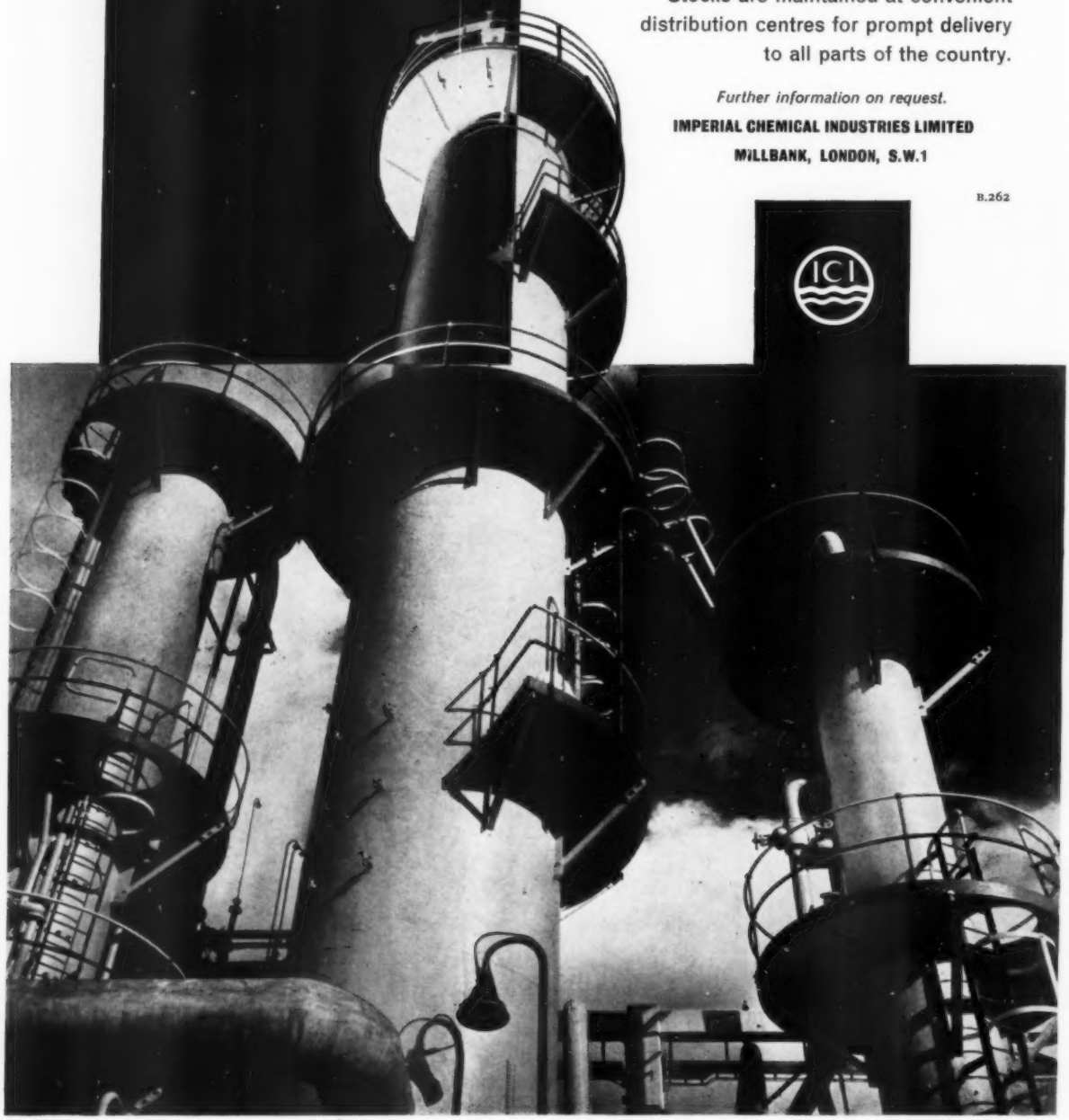

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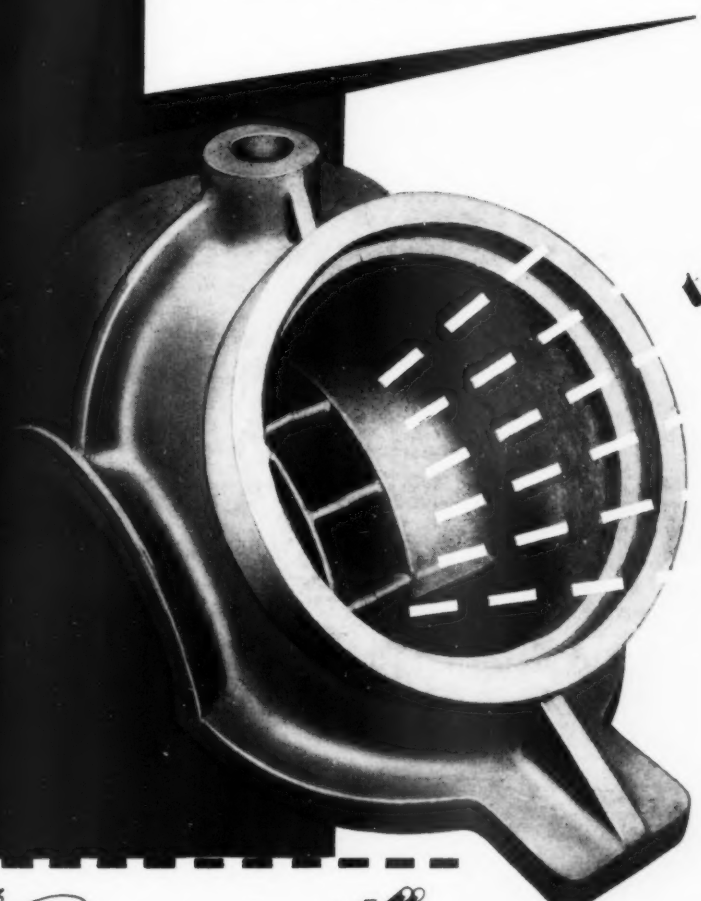

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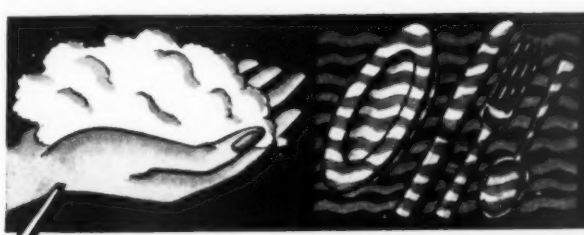

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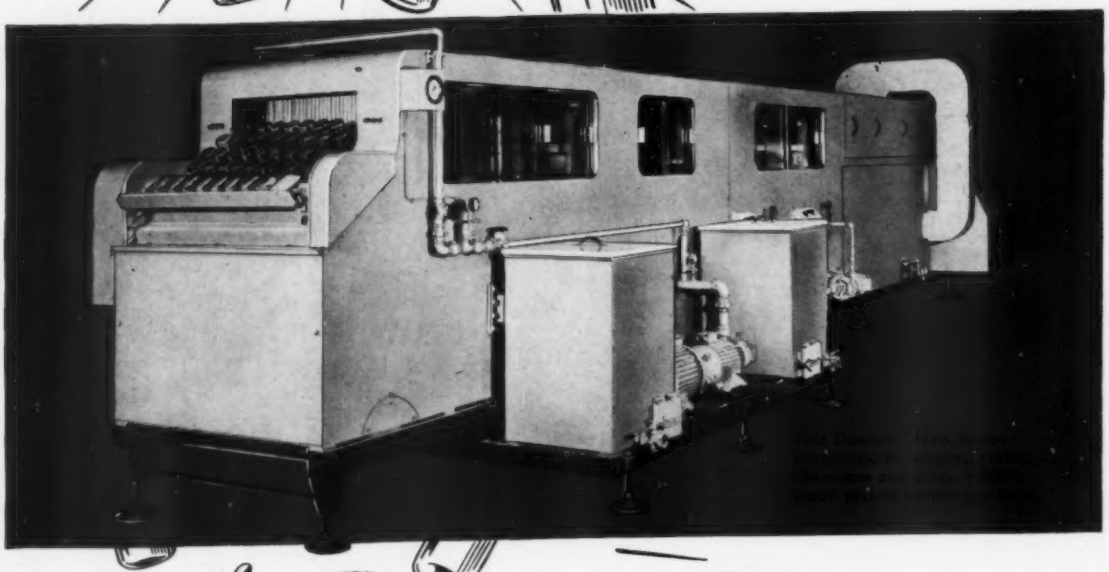

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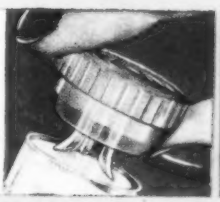

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# MANUFACTURING CHEMIST
## *and Manufacturing Perfumer*

Vol. XXIX, No. 9 — SEPTEMBER, 1958


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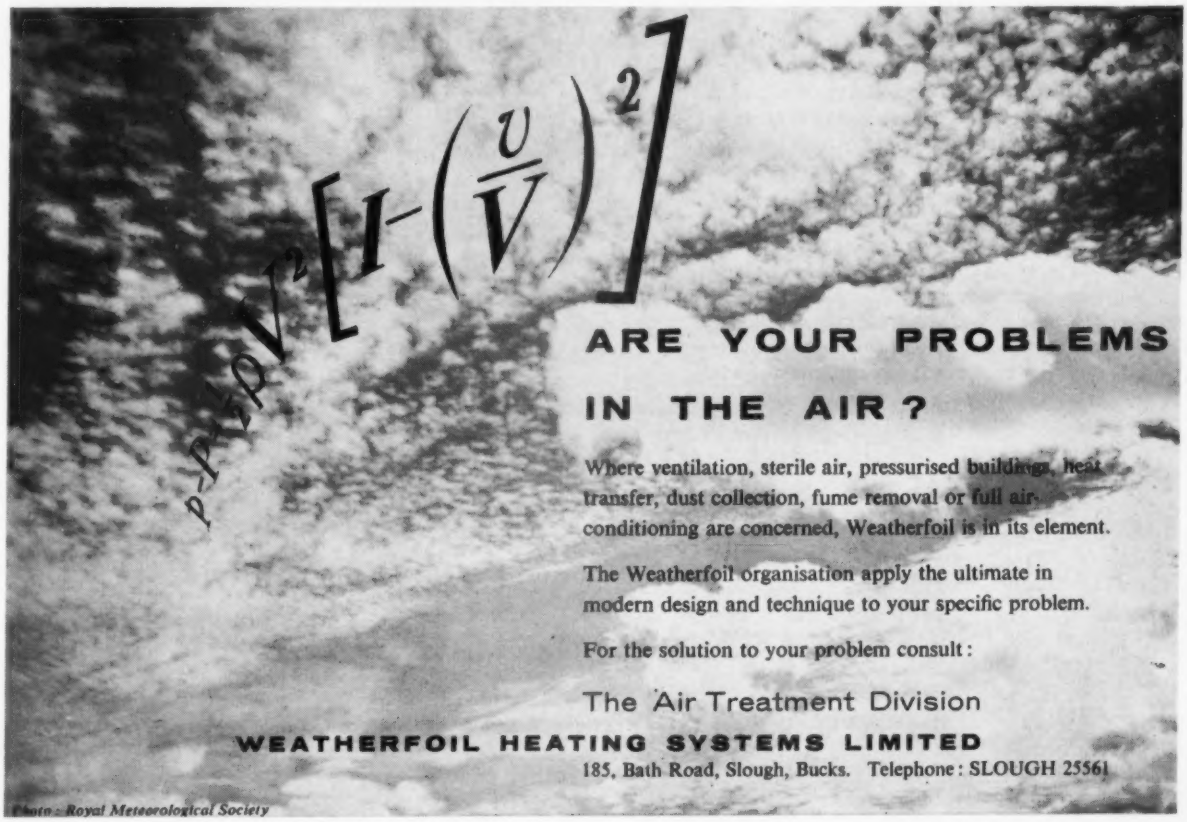
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# TOPICS AND COMMENTS

## A PEP-up for cosmetics

THE British cosmetic industry emerges with flying colours from a searching examination of its affairs by Political and Economic Planning. PEP is an independent, non-party organisation dedicated to studying matters of public concern, finding out facts and presenting them impartially. That such an organisation can find so much to approve of, even if implicitly, is highly gratifying and it is to be hoped that the industry will ensure that the PEP report (No. 425, 2s. 6d.) will be widely read.

Any idea that cosmetics are over-priced or that their quality is suspect is squashed by PEP. Of perfumes they say: "In view of their high quality they represent better value for money than many luxury goods." Of cosmetics generally it is pointed out that at the present rate of purchase tax (60%) less than half the shop price goes to the manufacturer, just under a quarter to the retailer and 29% in tax. Out of his gross return the manufacturer must pay for raw materials, packaging and handling (perhaps as much as 40% of the cost of production), wages, salaries, fuel, rents, rates, taxes, advertising and other sales expenses, and depreciation. After that he can make his profit. Of course this is not to say that the industry is struggling, though since 1948 no fewer than 760 cosmetic and perfumery firms have gone out of business. This in itself has not been a bad thing, because it has eliminated all except the better class of firm, the kind which can afford to make at reasonable prices the products the public wants.

There are now 240 firms in the industry, most either large firms themselves or controlled by large firms such as Unilever, Beecham, Gillette and Reckitts. According to PEP American firms dominate the field, firstly because the U.S. industry is the biggest and best organised in the world, and secondly because when controls were lifted here it was in a dominant position to expand sales through its manufacturing subsidiaries. American companies in Britain have continued to benefit from the research and development of their powerful parents which, of course, flourish in a considerably kindlier atmosphere than our firms (*e.g.* much lower sales tax).

Last year the British industry turned out £34 million-worth of cosmetics and perfumes of which £8·1 million were exported. The £25·75 million sold on the home market became £61·8 million over the counter owing to the retailers' rigidly observed mark-up of 50% and the Government's equally rigidly observed tax at the rate of 90% (since cut to 60%). So last year the public bought beauty aids at the rate of £3 for every female over 14. Not that every female buys cosmetics. A great many over 45 have either ceased using cosmetics or have never used them. Fortunately teenagers spend a lot of their increased incomes on make-up, and although many use it badly many, comments PEP, show considerable skill in the art.

Quality control of cosmetics in the U.S. is, of course, dictated by the strict standards imposed by the Food, Drugs and Cosmetics Act, while here there are no nationally imposed standards. PEP gives credit to the industry for its initiative in creating standards through the Toilet Preparations Association scheme. But the strongest incentive for high standards, thinks PEP, is the simple economic one; no firm is going to spend thousands of pounds on advertising technically unsound goods. Advertising expenditure has steadily risen and in 1957 £1,619,000 was spent on the press and £526,000 on T.V. This is twice as much as was spent in 1953. Max Factor are the pace-makers in this field, spending last year £90,600 on Creme Puff and £60,000 on lipstick. Another big advertiser was Smith and Nephew who spent £59,000 on Nivea cream.

The general picture presented by PEP is of a progressive industry, acutely conscious of technical standards and of its duty to give value for money. It would do even better if it did not have to contend with a 60% purchase tax, a rate far too high even if less than half the punitive 125% imposed up to March 1948.

## Science and the boardroom

Too many British businessmen still firmly believe that scientists and other experts should be on tap, not on top, should be advisers and assistants, not colleagues on the board of directors. This anachronistic attitude arouses in many scientists a reciprocal contempt for the art and skill of the businessman. It has been plain for a long time that industry can no longer afford this mutual distrust. Scientific discovery is useless unless it can be applied. Conversely business cannot provide the money to exploit inventions unless it utilises science. Britain cannot continue to be part of the privileged tenth of the world that enjoys what is called the Western standard of life unless it exploits to the utmost its resources of business skill and scientific knowledge. The two are completely and utterly interdependent and Sir Alexander Fleck, F.R.S., himself a perfect example of the scientist-businessman, has done a notable service by hammering home the essential partnership of science and business in his presidential address to the British Association, extracts of which we publish in this issue.

The gulf between scientists and non-scientists begins with our educational system, which tends to separate the study of the humanities on the one hand and science on the other at too early an age. The rich and powerful Victorians could afford the

luxury of an educational bias towards the classics. This tradition lingers. The cream of the country's intellect still tends to be drawn into professions other than technology and, for that matter, business. It seems that in both America and Russia people who practise the commercial and technical skills which make the economy tick are accorded a higher status than in this country.

Clearly then there must be an accelerated trend towards technology in our schools and universities. The aim should be to turn out scientists with a good knowledge of the humanities and non-scientists with an understanding of science. At the same time industry must increasingly harness the abilities of scientists in non-scientific fields—in management, sales and finance. If technological businesses require the knowledge of financial experts why should not financiers require the knowledge of technologists?

The necessity for a more enlightened and a more balanced partnership of science and business is so pressing in this second half of the twentieth century that merely to say so is stating the obvious. The fact that the president of the British Association finds it a suitable topic for a major speech is itself an indication of our backwardness.

## Trends of invention

As THE technological nature of society develops it is to be expected that the number of inventions will increase annually. This is confirmed by the latest report (for 1957) of the Comptroller-General of the Patents Office. Last year 40,498 patent applications were filed. Though this does not appear to be a great many more than in 1938, when nearly 38,000 applications were filed, account must be taken of the fact that under the Patents Act of 1949 an application claiming two or more Convention priorities is now filed as a single application, whereas before, a separate application had to be made for each Convention priority. There was an increase of over 5,000 in the number of patents sealed in 1957, the total being 25,205. But the staff of the Patents Office is still not big enough to cope with the flood of inventions. There is in particular a worrying dearth of technical staff, especially electronic engineers.

Analysis of the specifications accepted during the year shows that interest has been maintained in most of the important fields of invention. Among synthetic drugs interest in tuberculostatics was revived, and considerable attention was given to phenthiazine derivatives and tranquillisers from Rauwolfia alkaloids. There was increased activity in fluorinated organic compounds with unusual surface-active properties, in thiophosphoric acid esters, in high-density polyolefines and in terephthalic acid.

Many inventions in 1957 were concerned with fuel cells and in cells activated by seawater for life-saving purposes. In mechanical engineering considerable interest was shown in the development of pressure-exchangers, in which high-pressure gas acts on low-pressure gas in cells in a rotary body.

The Trade Marks section of the Patents Office dealt with 11,618 applications, 400 more than in the previous year, and there was an increase in the number registered—8,217 compared with 7,737. There were slightly fewer trade marks registered in the chemical products class—422 against 447. On the other hand, there were more in the pharmaceuticals class—900 against 767. The bleaching preparations, soaps and perfumery class accounted for 361 registrations against 343, while in the perfumery and toilet articles class there were four compared with nil in the previous year.

## Pest infestation research

UNTIL recently the main objective of D.S.I.R. Pest Infestation Research has been control of insects in food stores, factories, etc., and the disinfestation of imported foods. This is too limited—for infestation, like peace, is indivisible. Infestations that occur in overseas food on its way here, *en voyage* or even in stores in the producing countries, not only affect the food but may establish bridgeheads for new infestations here. So far, the Pest Infestation Research Laboratory has conducted liaison work with Colonial governments. It is now recommended—in the Laboratory's latest Report (H.M.S.O., 5s. net)—that the Laboratory should be able to take the initiative in tackling overseas problems.

The knowledge possessed by the Laboratory is probably unique, and its wider practical application overseas should greatly reduce food spoilage by pests; in special cases, staff might have to be sent overseas to investigate problems that are complicated by local climatic conditions, etc. There are few who would question the sense of this proposal, which must be of particular value to Commonwealth food-exporting countries. Certainly the chemical industry, with its interests in the supply of pest control chemicals, fumigants, etc., will welcome it.

## Immunity to insecticides

THE new Pest Infestation report gives further evidence of insect resistance to modern insecticides. This is no longer a problem of DDT alone. Grain weevils can breed generations with a fivefold increased resistance to pyrethrins. Houseflies can now become resistant to dieldrin, and the same strains have considerable resistance to gamma-BHC. The Report regards this problem as the most serious and challenging one facing insecticide research workers today, and the World Health Organisation has offered "very substantial financial support" for the Laboratory's biochemical research on resistance development. Some insect species have now developed virtual immunity not to one insecticide but to several—and this may undermine the striking progress made in food and health protection during the past ten years.

There are many items of special interest in the report. Further work using phosphine—generated from tableted aluminium phosphide—as a fumigant is described. Analytical difficulties have limited the assessment of tests; a reliable method for determining the phosphine in air and in the presence of ammonia and carbon dioxide is required. At present, however, it is thought that fumigation with phosphine will find less use in the U.K. than overseas. Progress in the control of clothes moths by virus spraying appear to have been disappointing. In a large-scale test the spread of the virus infection among moth caterpillars has been slow, much slower than in smaller-scale tests in which conditions favoured the spread of the virus. This may be an indication that the biological approach to controlling the clothes or wool moth will not compete successfully with established chemical methods.

The development of insect-proof packaging materials is an urgent need stressed in the Report. Fifteen types of material are being tested; the penetrative ability of different insects seems to vary appreciably, but so far 5-ply kraft paper and polythene film appear to offer a range of resistance that may be promising. Tests with insecticide-impregnated jute have shown some practical disadvantages.

## More drug addicts

DRUG addiction, though fortunately not a serious problem in this country, is on the increase. In 1957 there were 359 known addicts to manufactured drugs, 26 more than in the previous year. The figure includes 70 doctors, 2 dentists, 1 pharmacist and 15 nurses.

The United Kingdom Government report to the United Nations for 1957 states that most addicts are over 30 and that the greater proportion are women. Morphine, pethidine and diacetylmorphine are the drugs mainly used.

Illicit traffic in narcotics showed no significant change during the period under review. There were 14 seizures of opium by customs officials involving 5·3 kg. This shows a marked decrease over the previous year when 29 seizures were reported, involving 54·2 kg. The quantity of cannabis seized was, however, more than double the figure for 1956 although the number of seizures, 36, was one less. The total quantity involved was 237 2 kg. In many cases the cannabis was found in the form of mechanically compressed rectangular blocks weighing 350 g., and wrapped in brown paper.

No illegal imports of manufactured drugs were discovered, but a small quantity of diacetylmorphine was confiscated from an addict as he was about to embark on a liner at Southampton Docks. There were 30 convictions involving manufactured drugs. Of these, 23 were convicted of unlawfully procuring or possessing manufactured drugs, most of them being addicts who had obtained drugs from more than one doctor at the same time. The remainder were convicted for failure to keep drugs in a locked receptacle or failure to maintain appropriate records.

The dangers of drug addiction multiplying have, fortunately, been recognised for some time in medical and Parliamentary circles and it was recently announced by the Ministry of Health that an enquiry is to be held by a committee under the chairmanship of Sir Russell Brain, former president of the Royal College of Physicians with the President of the Pharmaceutical Society as one of the members. The committee will review the advice given by the departmental committee on morphine and heroin addiction in 1929 in the light of more recent developments. One aspect of its work will concern the possible need for treatment in State institutions specialising in these problems. At present treatment can be obtained at some public hospitals, and also at a number of private nursing homes which are primarily concerned with alcoholics.

## Arsenic in detergents

A QUITE unexpected connection between pyrites and the presence of arsenic in detergents has been reported by hospital and university workers in Glasgow. The discovery arose during experiments on activation analysis for estimating the arsenic content of hair, skin, nail and other tissues. This sensitive method enables the arsenic content of even a single hair to be determined. Hair samples for testing were provided by women colleagues in the laboratory and in these arsenic levels of up to 42 p.p.m. were found. Even the cleaning of samples by soaking in detergent solution overnight made little difference to the arsenic content.

The unusually high content of arsenic led to a check on eight different detergents. Two were of the type used to clean the hair by soaking and these proved to have arsenic contents of 74 and 59 p.p.m. The other six had contents ranging from 0·5 to 8·5 p.p.m.

Further enquiry showed that the two high-arsenic detergents contained ingredients which apparently had been sulphated or sulphonated with sulphuric acid made by the lead chamber process from pyrites, which often contains arsenic as an impurity. Sulphuric acid is now generally made by the contact process in which sulphur dioxide and air are passed over a catalyst to form the trioxide. Since arsenic may poison the catalyst great care is taken to remove it from the dioxide. Acid made from sulphur in the contact process is almost free from arsenic and even if made by the lead chamber method it is relatively pure.

As soon as the Glasgow findings were reported to the manufacturers of the high-arsenic detergents they took immediate steps to replace the arsenical sulphuric acid used for sulphation by brimstone acid. This prompt action was taken even though the concentration of arsenic was probably not

dangerous. The analyses were made on undiluted materials, but if used in the usual solution form in the laboratory or in the home there would only be about one part of detergent in 200-300 parts of water. In *Nature* (1958, **181,** 1463) the Glasgow workers explain the curious chance which caused the enquiry to be made. The washed samples of hair had clearly absorbed arsenic from the detergent solutions applied in the hope of cleaning them. The high arsenic levels in the untreated hair from the women assistants were attributable to the practice of washing hair with undiluted detergent and not rinsing adequately. What is surprising is the apparently not uncommon practice of women using household detergent instead of shampoo.

## Interferon and virus disease

ONE of the most promising advances yet made in the long and disheartening battle against virus diseases is the discovery of interferon by Dr. A. Isaacs and his colleagues at the National Institute for Medical Research. Interferon interferes with the growth of viruses. It appears to be active against many viruses including vaccinia virus.

The discovery sprang from one made over 20 years ago that one virus may be used to hinder the growth of a completely different virus. To do this it does not have to be active itself. But because the non-infective virus particles are themselves often toxic viral interference could not be used therapeutically. Working on these lines Dr. Isaacs and his colleagues found that when virus inactivated with ultraviolet light was incubated with cells in a buffered salt solution a substance was formed which itself had the power to interfere with virus growth. This is interferon. It is strongly believed to be a protein, but because it has not yet been isolated in a pure form its exact chemical constitution has not been established.

The first batch of interferon was made with influenza virus incubated with chick chorio-allantoic membrane, but it can be made with other viruses (*e.g.* Newcastle disease and fowl plague) and with other tissues (*e.g.* monkey kidney cells). Exactly how it interferes with the challenge virus is not known. It does not interfere with the challenge virus outside the cells nor does it prevent its absorption by the cells. So its action is certainly intra-cellular. A clue to its action is given by the fact that interferon is produced only by a virus lightly damaged with ultra-violet irradiation. (It is not produced by a living virus or by one inactivated by prolonged exposure to heat or U-V.) There is some evidence that the damage caused by slight irradiation may be directed particularly at the viral ribonucleic acid (RNA), the all-important constituent which may govern by genetic means the growth of the smaller viruses. Thus, according to the M.R.C. report, interferon might be an analogue of a substance which is normally produced early in virus multiplication through the agency of RNA —an analogue sufficiently different from this hypothetic intermediate substance to be of no use in the virus multiplication cycle but sufficiently similar to block some essential further step in virus growth.

Optimum production conditions for interferon have been worked out and if necessary large quantities could be produced. It can be readily concentrated some hundreds of times from weak solutions. It is stable in fairly strong acid solutions and at refrigerater temperature. But it is unstable above 60°C.

Interferon is non-toxic in doses used so far, but whether it will become a practical means of treating virus diseases like colds and influenza depends upon further trials now being done at the N.I.M.R. These include: Tests of the effect of inactive virus and of interferon on the multiplication of different viruses in animals. Attempts to isolate, purify and characterise interferon chemically. Experiments to elucidate its mode of production and the nature of its action.

Whether or not it becomes a practical medicine, interferon is a major step forward in virus research. It could prove to be as dramatic an advance in therapeutics as the antibiotics.

## Skin in hazard

THE increasing complexity of cosmetic formulæ and the constant introduction of new ingredients inevitably heighten the risk of allergic skin reactions among people with susceptible skins. It is a tribute to the care exercised by manufacturers that the incidence of serious effects is low. No figures are available in this country, because deaths from accidental poisoning are classified according to the chemical involved and not according to the product in which it was present. However, in the U.S. a survey showed that only 3% of 15,000 cases of chemical poisoning accidents were due to cosmetics, and it is fair to assume that an investigation in this country would disclose the same pattern. In the American study nail lacquers and polish removers, shampoos, permanent waving solutions and neutralisers, perfumes and lotions, were most frequently the cause of accidents.

In a comment on this report (by the American Medical Association), the *British Medical Journal* emphasises the care which manufacturers exercise to ensure that their products are completely harmless and remarks that " cosmetics employed for the purpose for which they are intended provoke reactions in only a very small proportion of users." Nevertheless the manufacturer is constantly exposed to the bizarre and unexpected. Recent examples are papules under the arm after using deodorant sticks containing sodium zirconium lactate, and hand dermatitis caused apparently by the synergistic action of household detergents and triethanolamine in a hand lotion. The constant vigilance required to defeat these hazards is a little publicised aspect of the cosmetic industry's work.

This fine building at Eastbourne, Sussex, is part of the international Armour organisation whose HQ are at Kankakee, Illinois, U.S.A. Here Armour Laboratories Ltd., use American methods to produce hormones, liver products, surgical ligatures and sutures, etc.

# Dollar Technology in Britain

## AMERICAN STRENGTH IN PHARMACEUTICALS AND COSMETICS

**The extent and implications of American investment in British manufacturing industry are examined in a new book. Inter alia, the author reveals the extraordinary strength of American firms in the pharmaceutical industry; of 24 manufacturers of ethicals, 13 are American**

MANY British industries, particularly pharmaceuticals, have been deeply penetrated by American firms who have set up either wholly or partly owned manufacturing subsidiaries. The first American manufacturing subsidiary was set up over a century ago. Since then there have been three surges of transatlantic investment in this country, from 1870 to 1914, from 1919 to 1939 and again since the war. The Americans own or partly own manufacturing capacity in this country worth over 1,200 million dollars, and this investment is increasing at the vigorous rate of 10% p.a. More than 300 branch subsidiaries of American corporations and jointly-financed Anglo-U.S. concerns give employment to nearly 350,000 Britons and produce a wide range of consumer and capital goods. In 1956 their gross sales turnover was £850 million and their exports accounted for one-tenth of all U.K. exports.

The American invasion is clearly a powerful influence on British industry. Which industries are affected from the viewpoint of competition? What business and management methods are used? What of the impact of American research and technology? These are some of the questions that Dr. J. H. Dunning, economics lecturer at Southampton University, sets out to examine and answer in his new book "American Investment in British Manufacturing Industry" (Allen and Unwin, pp. 365, 35s.).

The book opens with an historical introduction from which it appears that one of the earliest American incursions into the British pharmaceutical industry was that of Parke Davis and Co. in the early years of this century. Another important one occurred in 1922 when Sir Jesse Boot sold all the Ordinary shares of Boots Pure Drug Co. to Liggetts International Ltd. The shares were transferred to the United Drug Co. in 1925. But the Americans made no attempt to direct the business, which continued on the lines laid down by Sir Jesse Boot. In 1933 a financial crisis in the affairs of the American company forced a repatriation of the £1 million holding and Boots became British once more.

In the next chapter the present scope of American participation in British industry is examined, followed by a survey of its structure, organisation and geographical distribution. The Great West Road in London and Welwyn Garden City were the favoured spots in the thirties. Since the war development areas around Glasgow and Dundee have accommodated the immigrants.

Next Dr. Dunning deals with operating methods and productivity. British subsidiaries generally work as efficiently as their parents in the States, but often the smaller market here prevents them making the fullest use of the best techniques. The lesson is that comparable British firms ought to be able to reach a level of productivity "at least three-quarters" that of their U.S. competitors.

There follows a chapter on the influence of U.S. firms on U.K. suppliers; generally it has been a good one, says Dr. Dunning. Small firms especially have profited directly by the size of the orders given and indirectly through the insistence on efficient production methods and closer tolerances.

The last three chapters deal with the products supplied by U.S. firms, the influence of their managerial techniques on British policy and thought, and finally the overall effects and future prospects of U.S. directed investment in Britain.

Dr. Dunning's conclusion is that U.S. investment should continue subject, of course, to the present control on the type and size of the investment. He thinks that food, toilet preparations and household goods are the fields in which there may well be more U.S. investment as British living standards and, thus, the demand for these products rise.

### Which industries?

Engineering and shipbuilding (67 U.S. affiliated firms, 77,000 employees), vehicles (6 and 56,000) and chemicals and allied trades

(48 and 31,300) are the industries in which American participation is heaviest. Others are food, drink and tobacco (13 and 16,400), precision instruments (9 and 16,200), electrical goods (10 and 13,600) metal manufacturing (11 and 8,400), wood, cork, paper and printing (7 and 4,400) and textiles and clothing (7 and 3,900).

### Pharmaceuticals

The most spectacular recent expansion in American manufacturing in this country has been in ethical specialities. Dr. Dunning states that of the 24 U.K. companies specialising in this field no fewer than 13 are U.S. subsidiaries. Only seven of the 24 are British owned. Three are Swiss controlled and one is financed partially by French capital.

American pre-eminence in ethicals is attributed to the dominant position reached in antibiotics (on which 20 million dollars p.a. are spent for research), hormones, vaccines and other new drugs. Probably nearly two-thirds of the new ethical proprietaries prescribed by doctors since the war have been originated in America and have been made in this country either by U.S. subsidiaries or by British firms under licence. As a result of the efforts of such firms as Parke Davis, Squibb, Abbott, Lilly, Lederle, Pfizer, Searle, Bayer Products, etc., U.K. imports of antibiotics fell from £4·8 million in 1954 to £400,000 in 1955.

Over a score of U.S. subsidiaries produce proprietary medicines in Britain. Generally they do not supply ethicals as well, but some are in both fields, *e.g.* International Chemical, Sterling Drug, and Vick International. As for manufacturing chemists as such, the best-known American names in this country are Wm. R. Warner, Mentholatum Co., Miles Laboratories, Evans Chemicals Ltd., Bristol-Myers Co., and Chesebrough-Ponds.

To sum up, almost all the important American drug houses are represented among the 25 subsidiaries now manufacturing in this country and between them they employ 8,500 workers. They account for a substantial proportion of the £140 million-worth of pharmaceuticals produced annually in this country.

### Cosmetics, soap, etc.

It is thought that American firms supply about half of all the cosmetics consumed in Britain. For

## 66 American-financed Firms in the British Pharmaceutical, Cosmetic and Chemical Industries

From "American Investment in British Manufacturing Industry," by John H. Dunning (Allen and Unwin, 35s.).

**Key to financial classification**

A—Fully owned subsidiary or branch plant (apart from qualifying shares held by U.K. directors).
B—Anglo-American financed firms with 25% or more of its equity share capital U.S. owned.
C—U.K. subsidiary of, or firms partially financed by A or B above.

| *Name of U.K. company or U.S. branch* | *Financial classification* | *Products manufactured* |
|---|---|---|
| Abbott Laboratories Ltd. | A | Pharmaceuticals |
| Acheson Colloids Ltd. | A | Colloidal graphite dispersions |
| Allcock Products Ltd. | B | Medicinal products |
| Angier Chemical Co., Ltd. | C | Medicinal products |
| Arabol Manufacturing Co. Ltd. | A | Adhesives |
| Arden, Elizabeth Ltd. | A | Toilet and beauty preparations |
| Armour and Co. Ltd. | A | Hormones |
| Bakelite Ltd. | B | Plastics |
| Bayer Products Ltd. | A | Pharmaceuticals |
| Boyle, A. S. and Co. Ltd. | C | Pharmaceuticals |
| Bristol Myers Co. Ltd. | A | Medicinal and toilet preparations |
| British Oxygen Arc Equipment Ltd. | A | Liquid oxygen and nitrogen equipment |
| Cabot Carbon Ltd. | A | Carbon black |
| Chesebrough-Ponds Ltd. | B | Proprietary articles and toilet preparations |
| Cocker Chemical Co. Ltd. | C | Toxaphene |
| Colgate-Palmolive Ltd. | A | Proprietary articles and toilet preparations |
| Cyanamid Products Ltd. | A | Pharmaceuticals |
| Denver Chemical Mfg. Co. | A | Pharmaceuticals |
| Du Pont Co. (United Kingdom Ltd.) | A | Chemical products |
| Esso Petroleum Co. Ltd. | A | Petroleum products |
| Ethicon Sutures Laboratories Ltd. | A | Sutures |
| Evans Chemicals Ltd. | B | Medicinal products |
| Factor, Max and Co. | A | Cosmetics |
| Forth Chemicals Ltd. | C | Styrene monomer |
| Foster McClellan Co. | A | Medicinal products |
| Gemec Chemical Co. (a division of Union Carbide Ltd.) | B | Chemicals |
| Grange Chemicals Ltd. | B | Synthetic chemicals |
| Gray, Dorothy Ltd. | A | Beauty preparations |
| Hedley, Thomas & Co. Ltd. | A | Soap products |
| Hercules Powder Co. Ltd. | A | Paper-makers' chemicals, etc. |
| Honeywill-Atlas Ltd. | B | Sorbitol and surface-active agents |
| Hudnut, Richard Ltd. | C | Cosmetics |
| Johnson and Johnson (Great Britain Ltd.) | A | Surgical dressings, etc. and baby products |
| Johnson, S. C. and Son Ltd. | A | Wax polish |
| Kemet Products Ltd. | B | Metallurgical and electrochemical |
| Lambert Chemical Co. Ltd. | C | Medicinal products |
| Laporte Chemicals Ltd. | A | Chemicals |
| Lehn and Fink Products Ltd. | A | Toilet creams, deodorants, etc. |
| Leicester Lovell and Co. Ltd. | A | Synthetic resins and glue products |
| Lilly, Eli and Co. Ltd. | A | Pharmaceuticals |
| Luft-Tangee (London) Ltd. | A | Cosmetics |
| Mentholatum Co. Ltd. | A | Medicinal products |
| Merck-Sharp and Dohme Ltd. | A | Pharmaceuticals |
| Midland Silicones Ltd. | B | Silicone fluids, greases, etc. |
| Miles Laboratories Ltd. | A | Proprietary medicines |
| Mobil Oil Co. Ltd. | A | Oil products |
| Monsanto Chemicals Ltd. | B | Chemicals |
| National Adhesives Ltd. | B | Adhesives |
| Ortho Pharmaceuticals Ltd. | A | Gynaecological specialities |
| Parke-Davis and Co. Ltd. | A | Pharmaceuticals |
| Pfizer Ltd. | A | Pharmaceuticals |
| Phillips, The Chas. H. Chemical Co. Ltd. | A | Proprietary articles, medicines |
| Revlon International Corporation | A | Cosmetics |
| Rubinstein, Helena Ltd. | A | Cosmetics |
| Scherer, R. P. Ltd. | A | Filled gelatin capsules |
| Siris, A. J. Products Ltd. | B | Cosmetics and toilet articles |
| Squibb, E. R. and Sons Ltd. | A | Pharmaceuticals |
| Stafford-Miller Ltd. | A | Dental fixatives |
| Tokalon Ltd. | C | Cosmetics and beauty preparations |
| Toni-Cosmetics Ltd. | C | Cosmetics, hair shampoos, etc. |
| Upjohn of England Ltd. | A | Pharmaceuticals |
| Vick International Ltd. | A | Medicinal products |
| Wallace and Tiernan Ltd. | A | Water sterilising equipment |
| Warner, W. R. and Co. Ltd. | A | Medicinal products |
| White Laboratories Ltd. | A | Pharmaceuticals |
| Wyeth, John and Bros. Ltd. | C | Pharmaceuticals |

Thomas Hedley, part of the Procter and Gamble business since 1930, opened this £500,000 research building for detergents and cleaning products at Newcastle, last year.

the most part they concentrate on high-quality products. Most of the big names—Arden, Rubinstein, Max Factor, Revlon — were established here before the war. There is less American investment in the perfumery industry, which tends to be dominated by French interests.

In spite of Unilever, it is likely that most of the synthetic detergents produced in this country come from two American firms—Hedley and Colgate-Palmolive Ltd. These firms employ 4,500 people and supply household soap and various kinds of toilet preparations as well.

American influence is also prominent in the manufacture of polishes, adhesives, surgical dressings, sealing compounds, paper-making chemicals, herbicides and disinfectants.

**Chemicals and petroleum**

Of the six leading U.S. chemical companies—Union Carbide, Monsanto, American Cyanamid, Dow, Du Pont and Allied Chemical—the first five operate branch factories in Britain. However, only one, Monsanto, with over 200 basic products, might be called an all-purpose manufacturer. The others are extraordinarily selective and produce nothing like the range of products made by their parents. There is virtually no U.S. capital in the manufacture of dyes (except boot and shoe dyes), acids, alkalies, explosives and salts.

About one-third of the U.K. petroleum refining industry is run by two U.S. firms — Esso and Vacuum Oil. Between them they employ upwards of 6,500 people. Since 1943 they have invested over £80 million in this country.

**Managerial methods**

The 205 firms which co-operated with Dr. Dunning in his survey were asked at one phase of the enquiry to say whether they were A. strongly controlled, B. partially controlled or C. negligibly controlled by their parent companies. Forty-nine firms admitted to being in category A; in 23 of them the managing director was an American. Strong parental control seems to be particularly evident in pharmaceutical and cosmetic firms and the running of the branch plant is very much in the hands of the managing director or other top executive, who is invariably on the board of the parent company. Among firms in category A are Hedleys and Elizabeth Arden.

Fifty-nine firms decided they were in category B—partly controlled—though 41 were fully-owned subsidiaries. Esso, Monsanto, Ford and Alfred Bird are prominent companies in this category

Forty-two firms said they were negligibly controlled. In no case was the managing director an American and with few exceptions the products produced in the U.S. and U.K. factories were different.

To sum up: strict control seems to be most strongly exercised over subsidiaries in the pharmaceutical, cosmetic, toilet preparations, tyre, office machinery and foundation garment industries.

**Conclusions**

It is impossible to even begin to summarise the many interesting conclusions arrived at by Dr. Dunning. The book is a valuable consolidation of existing knowledge, but many of the questions it raises are more important than those it answers. The general impression is that American industrial methods flourish in the climate of Britain. The number of failures is small and the rate of expansion large. The book has many lessons for British managements. It also has many for society in general. If one were asked to single out a reason for the American success story it might be this: "The American economy offers more pronounced incentives to efficient management than that of this country. The pecuniary rewards both before and after tax are higher and the business man commands more social respect than in the United Kingdom, where over the years the emphasis has been directed to the professions, which still tend to attract a large part of the cream of the country's intellect."

If the American industrial invasion helps to change this attitude it will not be the least of its benefits.

American Cyanamid's subsidiary, Cyanamid of Great Britain Ltd., opened this £700,000 pharmaceutical factory for its Lederle Laboratories division at Gosport, Hants., a few months ago.

# Piping and Plant Design – Can Linear Programming Help?

by A. Battersby*

This paper is about an idea: if physical models can help us to design a chemical factory, may not mathematical models help us even more? To the best of my knowledge, no-one has ever tried to apply this idea in practice, so the argument must necessarily remain in the realms of pure theory. Nevertheless, the potential gains are great, both in capital cost and design effort, and this paper is submitted in the hope that people who know more about the subject than I do, will use it as a basis for criticism.

PHYSICAL models are being used more and more as an aid to general design problems in chemical plant, especially for piping, and an excellent review of this technique was given recently by Salisbury.[1] Its value is unquestioned, and yet, since such physical models can always be represented by mathematical analogues, might it not be even more valuable to begin with the mathematical model itself?

For example, the shape of the physical model may usually be reduced to the relative positions of a set of important points or areas capable of definition by a set of co-ordinates. Fig. 1 shows a chemical vessel defined by its geometrical centre $A_0$ and two points $A_1$ and $A_2$ from which pipes are to be run to other vessels. Then a mathematical model of this vessel is given by

$$\begin{array}{l} A_0\ (x_{10}, y_{10}, z_{10}) \\ A_1\ (x_{11}, y_{11}, z_{11}) \\ A_2\ (x_{12}, y_{12}, z_{12}) \end{array}$$

or even more compactly by

$$A_i\ (x_{1j}, y_{1j}, z_{1j}),\ j = 0,1,2$$

in which the first subscript gives the serial number of the vessel itself and the second gives the reference number of one of its important points. A zero subscript denotes the datum point by which the position of the vessel is defined: there is no reason why one of the connecting points should not be used for this purpose.

This is illustrated in Fig. 1, from which it is easy to see how a set of fixed parameters p, q, r may be deduced from the dimensions

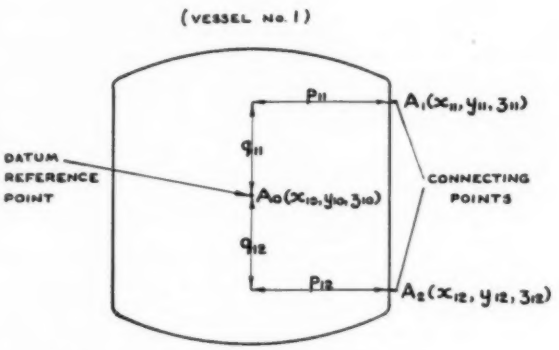



**Fig. 1. Derivation of mathematical model of a simple plant item.**

of the vessel and used to locate the connecting points relative to the datum point.

All the operations which can be carried out on physical models can be set up as mathematical models. If A (x,y,z) represents the position of any point before an operation and $A^1(x^1, y^1, z^1)$ its position after the operation, then the operation can be represented by a simple transformation. "Move A five units to the left and two units upwards" becomes

$$\begin{array}{l} x^1 = x-5 \\ y^1 = y+2 \\ z^1 + z \end{array}$$

and "rotate A ninety degrees anticlockwise in the horizontal plane" becomes

$$\begin{array}{l} x^1 = -z \\ y^1 = y \\ z^1 = x \end{array}$$

More complex operations can be represented by transformations which may be more complicated (but not necessarily: the operation of turning a vessel A into its own mirror image is mathematically very simple).

### Models of piping

The argument so far has shown that mathematical models of individual items of plant can be made to represent all the movements which physical models may undergo. Having accepted such models for the vessels, the extension to the piping which connects them is obvious and is shown in Fig. 2. It is easy to see from this how the lengths of piping are deduced from the co-ordinates of the connecting points. For instance, the total length of piping between $A_2$ and $B_1$ is given by

$$A_2B_1 = |(x_{12}-x_{21})| + |(y_{12}-y_{21})| + |(z_{12}-z_{21})|$$

The diameter and material of this pipe being specified, we shall know its cost per unit length $m_1$, and we can therefore set up an expression to represent the total cost of the piping needed to connect all the vessels as required by the designer. We can then express all the connecting points in terms of the datum points: *e.g.* in Fig. 1.

$$x_{11} = x_{10} + p_{11} \qquad \text{(p, q and r may have negative values)}$$

$$\begin{array}{l} y_{11} = y_{10} + q_{11} \\ z_{11} = z_{10} + r_{11} \end{array}$$

* A. Boake, Roberts and Co. Ltd.

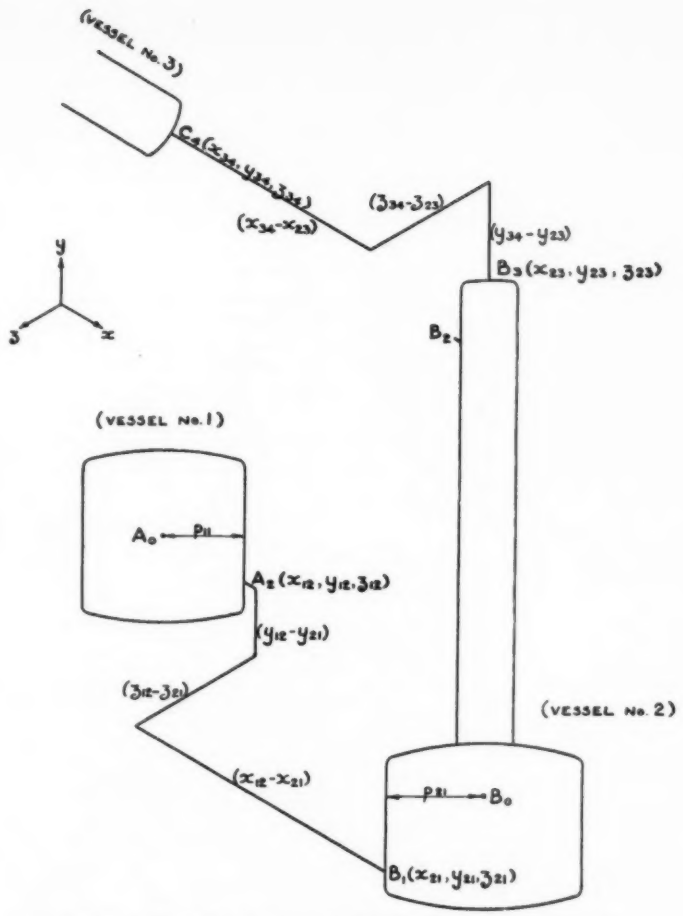



**Fig. 2. Derivation of mathematical models of piping connections.**

We finally arrive at a total cost of piping, M, in terms of two sets of figures,

(*a*) a set of *variables* x,y,z which define the positions of the vessels;

(*b*) a set of *constants* p,q,r,m which are fixed by the design specification.

The problem is now to minimise M, but before we do so we need to consider other restrictions which must be met.

## Restrictions

If we write

$$x_{20} = x_{10}$$
$$y_{20} = y_{10}$$
$$z_{20} = z_{10},$$

we have specified an impossible condition in which vessels A and B in Fig. 2 occupy the same space at the same time. The restrictions which automatically prevent this from happening with a physical model must also be built into the mathematical one. If the radius of vessel A is $p_{11}$ and that of B is $p_{21}$, then we must write

$$|x_{20} - x_{10}| \geqslant p_{11} + p_{21} + a_{21} \quad \ldots\ldots (1)$$

By putting in $a_{21}$ we are able, in the same inequation, to specify a minimum clearance between the vessels.

Similar inequations can be drawn up for the other sets of co-ordinates: those along the y axis may be used, for instance, to specify pressure heads as well as clearances.

## The complete model

We can now gather all the equations and inequations into a complete mathematical model of the design requirements. This model will have certain characteristics: all the expressions will contain *linear* terms only, if we assume that we have adopted the usual convention of running pipes parallel to three orthogonal axes. Many of the restrictions will be inequations, such as

$$y_{68} < 100$$

which may be imposed by limiting the height of the building. There is also a cost function M which is to be minimised.

The number of variables will certainly be greater than the number of equations or inequations, and we therefore have a typical linear programming matrix. Linear programming is defined as:

" the maximisation (or minimisation) of a linear function subject to linear inequalities."

In this case, the linear function to be minimised is the cost M, and the linear inequations are the design restrictions.

## Solution to the problem

It is beyond the scope of this paper to discuss the methods of solving linear programming matrices. There are several reference books, that by Charnes, Cooper and Henderson[2] being probably the best known. This gives a method of solution (the " Simplex " method) in detail, as well as a separate theoretical discussion; the monograph by Vajda[3] is also useful.

However, the designer does not need to acquire the technique for himself, though no doubt the more conscientious will want to satisfy themselves of the validity of the theory. The calculations are laborious and are better undertaken by an electronic computer: at least three computer services in London have " library routines " for this purpose. In fact, the design of a complex chemical plant by such a method could not reasonably be carried out by unaided human brains.

The solution would give a set of values for the co-ordinates of the datum points, which would fix the positions of the plant items in such a way that the piping cost would be at a minimum *for the problem as formulated.* It would also enable the cost of deviating from the optimum arrangement to be calculated.

It is most unlikely that the first solution to be obtained would be satisfactory: this is not because of a fault in the method, but because the first formulation of a complicated linear programming problem is generally incomplete. An inter-

esting example of this is found in a paper by Brown[4]: linear programming was used to determine the cheapest diet which would supply at least the minimum requirements of twelve different food factors. The first solution did this, but included a high proportion of potatoes which gave an excessive calorie content. Subsequent solutions were restricted by having *upper* as well as lower limits for some of the food factors. (A similar case has been observed in our own Company when linear programming was applied to production planning.)

**Organising the data**

The first paragraphs of this paper are somewhat glib; they present the organisation of the data as a straightforward matter, albeit a tedious one. The difficulties were ignored so that the main argument could be reached quickly, but the crux of the problem is whether some of the difficulties can be overcome at all.

For example, the method as described so far would give several optimal solutions. Two of them would be mirror images of each other: others would give the same relative positions of the plant items, but with the reference axes rotated or transposed. This could be overcome by fixing the position and orientation of a key item and defining the orthogonal axes from it. The key item might even be the frame of the building itself.

Other difficulties are not so easy to solve. The theory treats pipes as Euclidean straight lines, and makes no provision for clearances between them. Again, designers try to leave clear areas of working space by grouping pipes in horizontal or vertical planes. Other objections could be raised by the piping designer, many of which can be met by mathematical ingenuity. Some on the other hand might prove to be fundamentally insuperable: for example, suppose we wish to connect point $A_2$ $(x_{12},y_{12},z_{12})$ to point $B_1(x_{21},y_{21},z_{21})$.

The total length of pipe needed is given by the expression

$$(x_{12}-x_{21})+(y_{12}-y_{21})+(z_{12}-z_{21})$$

as long as the following conditions are satisfied:

$$x_{12} \geqslant x_{21}$$
$$y_{12} \geqslant y_{21}$$
$$z_{12} \geqslant z_{21}$$

and these restrictions can reduce the mobility of the items in the mathematical model below that of the items of a physical model. It is for this reason that the equation given earlier transforms each of the differences to its modulus.

The Appendix to Salisbury's paper[1] is headed "Typical Procedure Schedule for Model Maker" and can be applied just as effectively to the procedure for a mathematical model as for a physical model. This schedule might well be used as a basis for a systematic presentation of the data in tabular form. The transformation of this into a linear programming matrix could be set up as another standardised routine on an electronic computer. This is not so far-fetched as it may at first appear; in fact, a standard computer routine for selecting the best design of heat exchanger is now being used by DuPont.[5]

Another trend in the same direction can be detected in a paper by Marsden.[6] He describes the systematic permutation of the individual items in designing a chemical plant, and uses, in effect, a geometrical model rather than an algebraic one. The number of arrangements of even a few items is very large; twelve items alone would have so many potential arrangements that the fastest computer would take thousands of years to select the best. Suppose, however, that we could select the item of plant which would give the greatest cost reduction by being moved to a new position. Having made this move, we should then select the next best move in the light of the changed circumstances, and so on. The number of possible arrangements would be greatly reduced, sufficiently to bring a final solution within the range of ability of a computer. This is, in fact, what linear programming does.

If we look again at the procedure described in the preceding paragraph—select a piece, move it to the best position, study the next move in the new environment—the process of design is seen to resemble a game of three-dimensional chess. Perhaps it is not irrelevant for the final reference[7] to be a paper on "Programming a Computer for Playing Chess."

**Acknowledgments:**

Thanks are due to my employers, A. Boake, Roberts and Co. Ltd., for permission to publish this paper and for help in its preparation.

(*References on page 373*)

# Designing in 3-D-Mo

**By E. Holmes, A.M.I.MECH.E., F.R.S.A.***

THE use of the 3-dimensional model as a design, construction and training tool is of quite recent origin as, in the past, models have been used principally for checking drawing work—or calculations—and also, of course, for exhibition and sales purposes. Recently impetus has been given to the adoption of the technique partly because of the increasingly complex nature of plants, particularly in chemicals and oil, and it is safe to say that the design model is accepted and is now in wide use in these and many other fields. It is of particular advantage in any industry where piping is complicated and forms a substantial part of the plant design—as in the manufacture of fine chemicals.

**Why use the third dimension?**

The first obvious answer is that it gives perspective the lack of which is a distinct and serious loss to design.

Again, production inefficiency often arises from poor design and *thoroughness* at the design stage can reduce the cost of production. Models are certainly thorough, with the added advantage that they also enable the designs to be carried out more quickly than can be achieved by the normal method.

Also, if the design falls short in performance, then the attention of technical staff, management, etc., has to be engaged to put things right and this will also involve waste of direct labour with heavy expense. The answer is to *analyse* at the design stage and the 3-dimensional model is the perfect instrument for this purpose.

It is a known psychological fact that apart from seeing more clearly, individuals will *think* more deeply in 3-dimensions and the design stage is certainly the least expensive stage to do the thinking.

Again, the use of the 3-dimensional model simplifies communication and obtains quick agreement, because it is precise.

The principal job of the design engineer is one of communication, trying to get his subordinates to do what he wants and trying to get other people to agree to what he has

* Managing Director, Industrial Models Ltd., Ashton-u-Lyne.

# 3-D-Models for Plant and Piping Design

Designing in three dimensions has obvious advantages and few drawbacks. The author explains how models are constructed and how they may be used for designing chemical plant and piping systems.

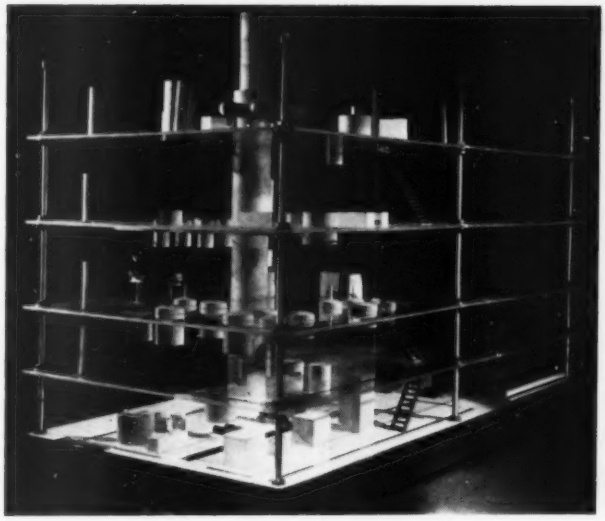
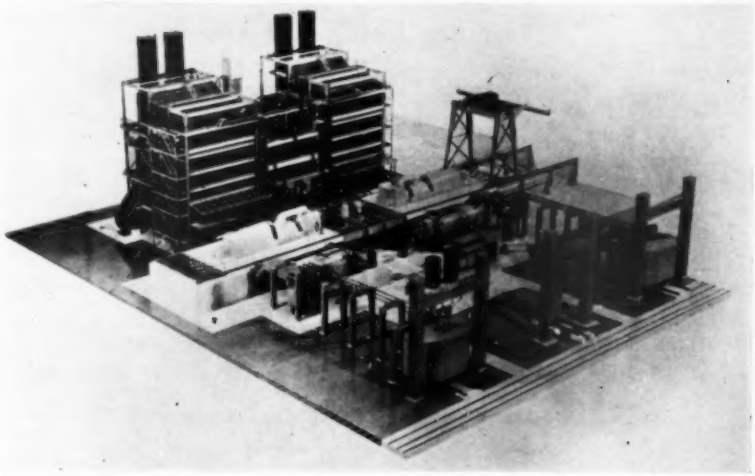


**Fig. 1. Preliminary layout model of a chemical plant. Below, Fig. 2. Final design model before installation of piping.**

done or wishes to do. He very quickly learns that the model is the ideal tool to make his points clearly, quickly and precisely. Because the model shows up *all* the physical variables, communication time is reduced for everyone concerned.

It is possible, with the model, to obtain firm decisons from customers, department heads and management, since they can see the variables and arrive quickly at decisions which usually stick.

A great many design problems



using the conventional 2-dimensional drawing method may be attributed to the fact that the designer who has a 3-dimensional idea in his head must translate it into 2-dimensions, then his reader must retranslate back to 3-dimensions (mentally) and try also to visualise what the designer has in mind. This double translation leads to misunderstandings, errors and delays, but with a model it is possible for the designer to convey his ideas in 3-dimensions *from the beginning* without any translation to 2-dimensions and back to 3-dimensions again.

The design model technique to be described involves the use of two distinct types of model, the first being the Preliminary Layout Model—this being essentially a 3-dimensional sketch—and the final design model or, when applied to the chemical industry, the piping design model.

### Preliminary layout model

A preliminary layout model for chemical plant is illustrated in Fig. 1. This unit can be used repeatedly for a variety of layouts and for different projects. It is, in fact, a layout kit which, when not in use, can be stored in a special container.

The Preliminary Layout Kit must be

(*a*) Simple in construction.
(*b*) Flexible in 3-dimensions.
(*c*) Capable of speedy alteration.

The equipment is merely representative in simple geographic forms. If buildings and structures are involved they should be largely fictitious and serve only to locate and carry the equipment pieces. The idea is initially to " suspend " the equipment in space.

Three-dimensional Layout work should be commenced on this model as soon as flowsheets and basic design data are to hand. It is *quite unnecessary* to prepare 2-dimensional layout drawings—the model is a 3-dimensional drawing board and it will be found that results will be obtained by this method of layout in a few hours as compared with many days, and perhaps weeks when using the usual 2-dimensional drawing technique. Even a complicated chemical plant should not take more than a day or two to model.

Scales are optional within limits, the usual being $\frac{1}{4}$ in. = 1 ft., and the first layout should be merely to conform to the flowsheet. All equipment pieces are very rapidly and easily moved and an evolutionary stage by stage process will soon arrive at the agreed plant arrangement. A dozen or so different arrangements can be examined and studied in a day or two, hence the need for a truly flexible model kit.

Before final agreement has been reached many major layout decisions will have been made and

the model will have been discussed and studied by those concerned with design, construction and plant operation. Most useful contributions to the layout can be obtained from management, work study, safety departments, etc. in addition to the design and construction staff. There are many people in this category who can improve the layout by their specialised knowledge but who are not often called upon to visualise in 3-dimensions from the usual drawings.

Agreement on layout having been reached work can then commence on the final design model (piping design model).

**Piping design model**

The question is bound to be asked "Why make an accurate model once the layout has been established —at least in principle"? There are several reasons for this, *e.g.*:

(*a*) The accurate model shows all variables in detail—templates do not and consequently lead to errors in planning—not only dimensional errors but, more important, errors from an operational point of view.
(*b*) The model indicates accurately how to make the best use of space and space saving is capital saving.
(*c*) It shows how to conserve labour as it can be clearly and perfectly analysed by Time Study and Work Study Departments.
(*d*) It shows up safety hazards.
(*e*) Quick decisions are obtained from management (and clients) as they do not have to pore over numerous 2-dimensional drawings.
(*f*) Sub-contractors are enabled to make quick and accurate bids—particularly on piping.
(*g*) The model can be used for future modifications and replanning in the light of advancing techniques, process changes, etc.
(*h*) Lighting can be accurately studied with consequent avoidance of shadows, etc.
(*i*) The strength of the construction team can be quickly assessed.
(*j*) The order in which plant items should be erected can be noted almost at a glance.
(*k*) Location of lifting devices for heavy or awkward lifts can be plotted and arranged in advance.
(*l*) The types of lifting devices and other construction equipment can be ascertained easily.
(*m*) Planning of scaffolding in proper sequence can be arranged both for construction and for such work as lagging and painting.
(*n*) The running of electrical cables, instrument lines, etc. can be done on the model.
(*o*) The obtaining of firm quotations for painting, lagging, etc., when done direct from the model can often result in quite an economy, as the contractors have a measurable and true picture and will at least cut down the "ignorance" contingency on his final estimate.
(*p*) The model can be used for the siting of auxiliaries not normally shown on drawings, *e.g.* fire extinguishers, hose reels, wash down points, racks, small containers, etc.

**Essential requirements for final design model**

This model—which is to be used as a design tool—must be made quickly and accurately.

Details of the steel structure or building frame are required, together with drawings or sketches of all plant items and equipment.

The structure is generally made from true-to-scale R.S. joists, channels, etc. in wood, the plant items in plastic materials. The entire model structure is mounted on truly flat base sections of a size not larger than 6 ft. by 3 ft., each section made so that a number of them can be dowelled together to form the complete model plant.

Floor and building details are in plastic material; chequer plate is represented by special wire gauze. Pipe branches are fitted to plant items with copper tacks.

Up to this stage (shown in Fig. 2), the model has been constructed and assembled by specialised tradesmen in the workshop but it is then necessary to transfer it to the design department so that piping and fittings can be installed as this design is carried out *without* the use of piping drawings.

**Installation of model piping**

This is design grade work which demands accurate workmanship. The personnel are pipe designers with skill in the manipulation of a number of small tools.

General principles of the piping layout having been broadly discussed and agreed the piping designer can proceed with the pipework, the only essential information required being line diagrams of all process and service piping, stating pipe diameter, insulation, valves, etc.

Piping is best represented by the wire and disc method involving the use of $\frac{1}{16}$ in. dia. or $\frac{1}{8}$ in. dia. wire, with fibre discs arranged to slide along the wire and representing the outside diameter of pipe or flange including insulation. This system —as opposed to full bore pipes— has the necessary accuracy and the wire forms the ideal pipe centre line for measuring direct from the model. Also, it is important that one should be able to "see through" the model as no pipe should be hidden, however small. Future photography of the piping arrangement too requires that visual obstruction is at a minimum.

The wire and disc method is possibly the only practicable technique of modelling chemical plants with complicated small and medium bore piping, such as exists in the fine chemicals industry. It is also good practice to show complete steam trap assemblies, site run piping, steam tracing, etc., on the model and the more complicated the arrangement the more essential this is.

A complete piped up model made by the wire and disc method is shown on Fig. 3.

**Detailing piping direct from the model**

It is not always necessary to prepare piping detail drawings as piping can be erected directly from the model, the only requirement then being a series of "plumber's sketches" taken directly from the model by a good pipe fitter. However, on larger plants requiring a major percentage of shop prefabricated pipework details are required. In any event, the speed and saving of time achieved by preparing these detail drawings from the model can be considerable, not only because of easy visualisation but also because of the large number of dimensions which can be measured direct from the model. This is particularly so when the piping is complex. It should also be remembered that piping arrangement drawings do not exist and there is no real necessity to have them prepared.

**Saving in piping design and construction costs**

Tangible savings are difficult to

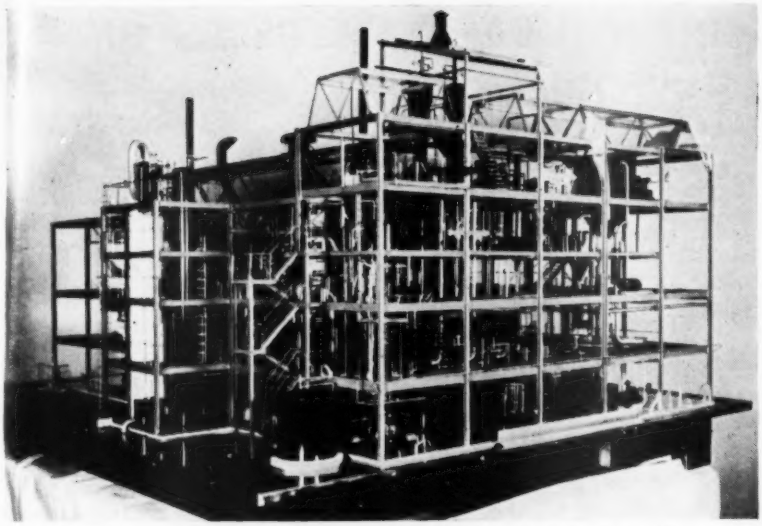


**Fig. 3. Final design model complete with piping (scale ⅜ in. = 1 ft).**

quote but it can be stated that generally the piping design costs will be reduced by as much as 20% to 40% as compared with the 2-dimensional drawing method.

Again, there is the saving arising from the elimination of unnecessary bends, tees, specials and so on, experience showing savings of 5% to 10% on the total piping cost. Piping interferences are eliminated during the design stage and not during construction or start-up when their elimination is very costly.

Another major saving is certainly in the ease of plant start up and the avoidance of initial major and minor modifications. These factors are covered by all concerned when the plant is at the design stage.

The training of plant operators and the preparation of operating instructions are greatly facilitated. In fact, operator training can start on the model even before the plant construction is complete, thus ensuring a faster start-up.

The cost of the completed piped up model depends upon the nature of complexity of the plant but the order of cost will be in the region of ¼% to not more than 1% of the total installed plant cost. This is therefore a relatively small proportion of the design charges, construction overheads, etc., which can easily be of the order of 10% to 12% of the total installed plant cost.

### Future developments

The usefulness of the model in *Work Study* has already been referred to and this usefulness continues to grow the more it is realised that it is a major error to build a plant and *then* to give consideration as to how it can be improved when modifications can be carried out simply and quickly on the small scale.

A further development is the use of photography in such a way that photographs can be printed and enlarged on special paper and dimensioned in the drawing office. This entails the model being " slice " constructed vertically and horizontally so that photographs can be taken at various sections and elevations.

Models are now being used for planned maintenance and also for the planning of modifications, new techniques, etc., on existing plants.

### Conclusion

The model technique has certain limitations, *e.g.* partly due to tradition, there is a reluctance to change and the proper use of the model requires that those using it will study and think on it rather than on paper. Enthusiasm is an essential requirement, particularly when the technique is being established. Also, one must restrain the " perfectionist " as here is an ideal tool for that type of individual.

Again, models are difficult to " file " and they also require appreciable space in the drawing office and on site.

Timing and co-ordination require very careful thought to ensure that the model is built quickly, but properly done there should be no delay.

It has been shown that the model can be used right through the design stage, in the field for construction, for the training of plant operators, for planned maintenance and for future plant modifications. Used correctly, major savings will certainly be achieved and although the first two or three projects may be difficult it will be found that once experience has been gained the model's use can and will be directed in such a way as to achieve maximum return for the investment.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## Piping and Plant Design

(*Continued from page 370*)


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**Chemical plant services.** A new and well-designed booklet describes the services offered by the British Chemical Plant Manufacturers' Association to plant manufacturers and users. It is intended primarily for firms enquiring about membership, but others interested in the Association may obtain copies free of charge on application to the Secretary at 14 Suffolk Street, London, S.W.1.

**Liquid level controllers.** Technical leaflet 1251 describes the Sunvic model 25 and 27 series. The company's **recording control station,** model 24 series, is dealt with in leaflet 1241.

**Sturtevant booklets.** 5303 " Newgate " Grit Collector; 7013 " Ludgate " Mechanical Dust Collector; 6510 Sturtevant Scrubbers. These leaflets have been issued by the Sturtevant Engineering Co. Ltd.

# Electronic Computation of Stresses in Pipe Systems

by C. F. Gradwell*

The pipe-stressing programme that has been written for the Ferranti Pegasus Computer may be used for steam and hydraulic pipe layouts in marine and industrial installations, power stations, chemical factories and oil refineries. The programme uses the method of pipe stress analysis developed by H. M. Gemmell of Yarrow and Co. Ltd., Scotstoun, Glasgow, and adapted for automatic computation by Ferranti Ltd. The programme is available to industry generally on a hire basis, as part of the Ferranti Computing Service.

## What the programme does

THE programme is capable of dealing with any multi-anchor system of pipe layout, up to a maximum of nine anchors. Each branch of the system (*i.e.* run of piping without intermediate offshoots) is assumed to consist of a number of sections which are either straight lengths of pipe, or plane circular arcs, with any orientation in space. The physical constants of the pipe may vary in any desired manner from section to section.

The basis of the calculation is to assume that one of the anchors remains fixed in space, while given deflections are applied to the remaining anchors, which may now be regarded as " free ends." These deflections, which have to be calculated by hand, are very easily computed from the coefficient of expansion of the pipe material and the co-ordinates of the free ends relative to the fixed ends. If in the actual pipe system all the anchors are absolutely rigid, we first compute the normal free thermal expansion of the ends, assuming that all of them except one (which may be chosen arbitrarily) are free to move. We may then ask the computer to find the forces and moments necessary to neutralise these free thermal expansions. Allowance may be made for " cold pull-up " and other anchor movements.

It is emphasised that the scope of the present programme is to compute the forces and moments at the free ends which are necessary to produce given linear and angular deflections there.

This is, of course, not the end of the calculation from the pipe engineer's point of view, although it is the major part of it. Extensions to the present programme are under consideration which will continue the calculation to the stage where actual stresses in the more highly stressed region of the system are printed out.

A further extension under consideration will allow the designer to take account of the effect of partial constraints in the system (guides for example).

It will be realised from this that what the computer does is carry out calculations for a *given* pipe system. We cannot (at the moment) simply ask the machine to design for us a pipe system which satisfies certain maximum stress conditions and certain geometrical restrictions. A trial design has still to be roughed out by a design engineer, but the great advantage of using a computer is that any such tentative design can be proved or disproved several hundred times quicker than by hand. Moreover, there is no need to limit the system to three or four anchors, which is the effective limit for manual computation.

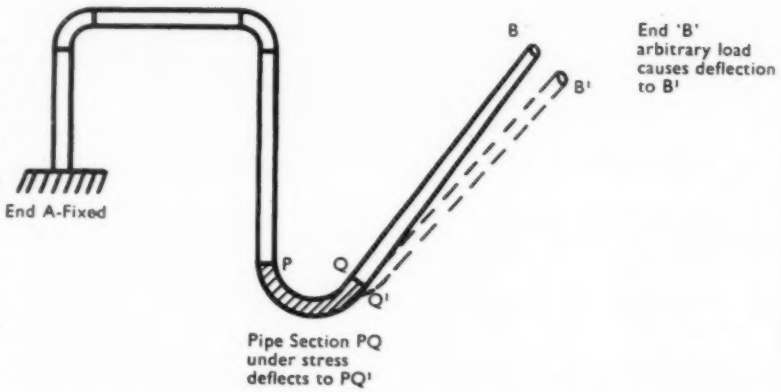



**Fig. 1. A length of pipe AB anchored at one end, A, with a load applied at end B.**

## Brief description of the method

Before giving any account of the method, it will be necessary to say a little about the way in which a computer records the elastic properties of any length of pipe. Consider a length of pipe AB anchored at one end A, and a load applied at the end B (see Fig. 1). This load in general consists of a force with three components X Y Z (referred to some convenient system of rectangular axes) and a moment with three components L M N. These six components may be written together in the form of a vector (X Y Z L M N), which is said to constitute the generalised load. Similarly we can think of the resulting deflection at end B as consisting of linear deflections x y z and angular deflections u v w, which may be compounded into a generalised deflection (x y z u v w). Any one deflection element (x, say) will in general depend on all six load elements, and one may write, for example,

$$x = a_{11}X + a_{12}Y + a_{13}Z + a_{14}L + a_{15}M + a_{16}N$$

where the a-coefficients denote flexibilities. Similar expressions may be written down for all the deflections in turn. The 6 by 6 array of coefficients thus defined describes com-

* Ferranti Ltd.

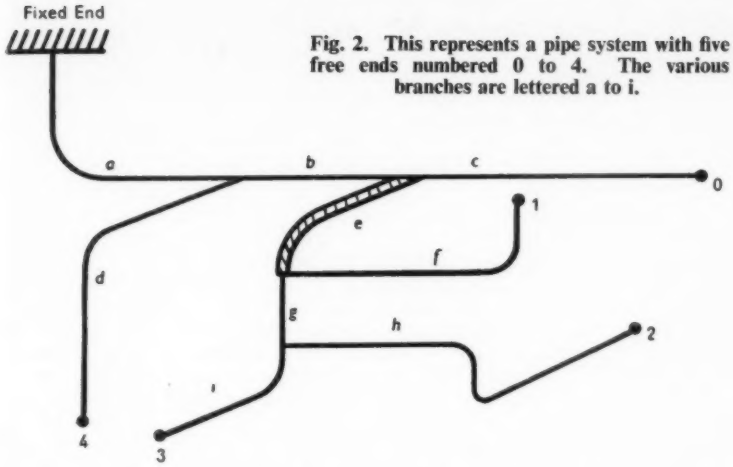



**Fig. 2. This represents a pipe system with five free ends numbered 0 to 4. The various branches are lettered a to i.**

pletely the elastic properties of the pipe section AB for the purposes of the present calculation. This array of numbers is called a flexibility matrix.

There are two main parts in the analysis. The first part consists of calculating the flexibility matrix for each branch in turn, on the assumption that the end nearer the fixed point of the system is also fixed, and that a load is applied at the other end.

Consider the branch AB in Fig. 1, in which end A is supposed fixed. Suppose an arbitrary force and moment are applied to end B of the pipe. Each pipe section will, in general, bend, and thus there will be a deflection at end B. This deflection may be regarded as the sum of contributions from the individual pipe sections, due allowance being made for the geometry of the system. An individual pipe section PQ (P being nearer to A) is considered as having a certain loading applied at Q, this loading being equivalent to the given loading at B, when transferred to Q. Now the deflection of Q, relative to P, due to a known loading at Q may be expressed in terms of a flexibility matrix, the elements of which may be directly computed from the physical properties of the section PQ. When this relative deflection is known, it may be transferred to B, thus giving the contribution from section PQ to the deflection at B, due to an arbitrary loading applied at B. What is actually calculated, of course, is a contribution to the flexibility matrix. This is done for each section in turn, and the sum of these matrices gives the flexibility matrix for loads and deflections at end B.

This calculation is carried out for every branch of the given pipe system.

### The multi-anchor flexibility matrix

If there are m free ends in the system, the complete flexibility matrix L will be of order 6m, and may be regarded as $m^2$ matrices $L_{hk}$ of order 6 by 6. The matrix $L_{hk}$ is the flexibility matrix of the free end $h$ with respect to the free end $k$. That is, given a load vector $F_k$ (of six components) applied at $k$, then the deflection produced at $h$ is $L_{hk}F_k$. The free end labels $h$, $k$ range from 0 to m-1.

Fig. 2 represents a pipe system with five free ends, numbered from 0 to 4. The various branches are lettered a, b . . . i for convenience. It will be seen that the flexibility of any one branch causes contributions to be made to a number of matrices $L_{hk}$.

Thus, in particular, branch e will cause contributions to the matrices $L_{11}$, $L_{12}$, $L_{13}$, $L_{22}$, $L_{23}$, $L_{33}$. The actual contributions depend on the flexibility of branch e itself, and the relative coordinates of ends 1, 2 and 3 with respect to the end of branch e. The flexibility matrix of branch e has to be pre- and post-multiplied by certain geometrical matrices in very much the same way as the flexibility matrices of the sections of branch e itself are treated. This is the basis of the multi-anchor programme. Each branch a, b, . . . i is computed in turn, and at the end of the computation for each branch the machine works out contributions to the various matrices $L_{hk}$. The values of $h$ and $k$ to be taken depend simply on the indices of the " downstream " free ends, *i.e.* those free ends on the side of the present branch remote from the fixed end. For branch e, say, the numbers given to the machine would be simply 1, 2 and 3, from which the machine would form the six combinations given above.

The matrix L is set to zero initially, and when every branch has been treated as above (so that the machine has now computed the final flexibility matrix L), a further data tape is read in on which the 6 given deflections at each of the free ends are punched. The set of equations, formed by the flexibility matrix L and the vector of deflections as the right-hand side, is now solved to give the loads at the free ends.

### The preparation of data tapes

The data tape is prepared in three sections as follows.

The first section consists simply of a table of coordinates of the free ends.

The second section consists of the branch details of each branch in turn.

All the sections of any one branch are treated in turn, starting at the " upstream " end. First of all, the letter S or C is punched according as the section is straight or curved. This letter is followed by other letters and numbers giving information about Young's modulus, stiffness, length (for a straight section), and radius, angle of arc, and Karman's constant (for a curved section). Where several consecutive sections have a common value for some parameter (Young's modulus, for example), this parameter need be punched only once. In the case of a curved section, information has also to be given about the orientation of the curve in space. This is done by taking a local set of right-handed axes Px, Py, Pz, at the beginning of the section P in the above notation. These axes are such that Px is tangential to the arc (pointing " downstream ") and Py is along the inward-drawn radius. The orientation of Pxyz relative to the standard axes is specified by the rotations that the standard axes would have to undergo in order to coincide ultimately with the local axes Pxyz. A typical chain of rotations might run: 90° about the x-axis, 30° about the new y-axis, 5° about the new z-axis. They would be punched simply as 90/1 30/2 5/3.

If the section is rigid, the shape is

irrelevant, and for such a section the letter R is punched.

As the machine reads in this tape, for each section it works out, and adds in, one more contribution to the branch flexibility matrix.

At the end of the branch information, the numbers of the downstream free ends are given, enabling the machine to compute contributions to be made to the various partial matrices $L_{hk}$ of the final flexibility matrix L.

The third section of the data tape consists of a list of the six given deflections at each free end in turn (*i.e.* there are 6m numbers altogether). Different sets of deflections can be taken into account simply by repeating the third part.

**Presentation of results**

When the tape on which the deflection data have been punched has been fed into the machine, the computer then begins to compute and print out the forces and moments at all the free ends in turn. These are printed with headings for identification purposes.

**Conclusion**

The times for doing this calculation are very dependent on the complexity and configuration of the pipe system. They are in all cases very short in comparison with hand methods; for example, a pipe consisting of a single branch with 20 sections would only take about 3 min., and it would be a very complicated multi-anchor system that took as long as an hour.

When using the previous hand methods it might have taken several months to stress a three-dimensional system with three anchors, this representing something like the practical limit. More complex systems often had to be simplified, by introducing, for example, further anchors which partitioned the complete system into manageable portions. With this programme, capable of tackling up to nine anchor points directly, the designer is given a new degree of freedom.

The input of deflection data and the calculation of the loads comprise the final stage of the calculation, and very little extra time is required to put in a whole series of sets of deflections, thus readily stressing the whole system under a wide range of physical conditions.

In consequence of the short time for the whole calculation, it may easily be repeated whenever the designer finds it necessary to alter the pipe system, either by changing the layout, or by adding a pipe, or by changing a pipe cross-section.

# Pipework for the Chemical Industry

Fabrication and erection • Vacuum pipelines • Glass, stoneware, bi-metal, titanium and resin-lined pipes • Plastic hose • Stainless steel fittings • Protective tapes • Heating tapes • Cleaning processes

## Pipework Fabrication and Erection

▶ Pipework and ancillary equipment for industry has been supplied by Aiton and Co. Ltd. for the past 50 years.

At present they are manufacturing high-pressure/high-temperature piping in austenitic and ferritic steels for pressures up to 3,400 p.s.i. and temperatures of 1,050°F. Their works at Derby and Sunderland are equipped with facilities for the design, fabrication and non-destructive radiographic examination as required by piping specifications. For the lower pressures, they supply piping in cast iron, carbon steel and stainless steel.

Aiton's ancillary equipment includes bellows, expansion joints made from pressings, with circumferential and longitudinal welds as required, or convoluted joints with only one longitudinal weld. Their Uniload support is of the constant-load type and can be supplied to allow adjustment on site. This support can also be completely weatherproofed so that no subsequent maintenance is required during service life.

Aiton specialise in complete projects, small or large, from design to installation, anywhere in the world. Full details of the company's pipework and ancillary fittings are given in a substantial catalogue of over 100 pages.

▶ Pipework of all classes, from $\frac{1}{8}$ in. to 24 in. or more nominal bore, for water, oil, steam, air and other services to British or American Standards, either flanged or screwed, is fabricated by Simmons and Hawker Ltd. in their works at Wandsworth and Feltham. Engineers are available to give advice on any pipework problem and special attention is given to clients' own standards and specifications.

A large stock of pipe is maintained to give quick deliveries.

As well as fabricating pipework Simmons and Hawker maintain a staff which specialises in the erection and site management of any job involving piping. The construction of complete installations and plants incorporating all classes of civil engineering and building work is undertaken. Facilities include a fleet of modern portable welding machines.

The company also has a team of men trained in the cleaning of tanks which have contained petrol or other explosive and toxic fluids.

## Vacuum Pipeline Systems

▶ The installation of a vacuum pipeline system requires a great deal of preliminary study as there are innumerable factors to be taken into account. For example, it is obviously necessary to know the total number of points required, but of equal importance is the maximum number in use at any one time. The length of piping involved can affect the size of the equalising chamber employed. Another vital factor is the provision of vacuum tight pipelines and stopcocks, for if the whole pipeline system has high leakage rate, then the pumps will cycle continuously regardless of the number of points in operation.

Methods of leak detection using the sensitive hydrogen/pirani method are employed in all vacuum pipeline systems installed by Edwards High Vacuum Ltd. Isolation valves are placed at strategic points in the system so that sections of pipework can be tested in sequence.

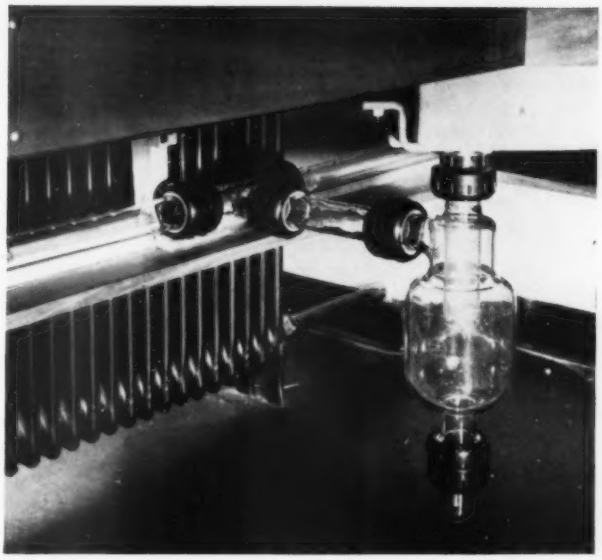
Edwards have added to their range of standard pumping units used for this type of work and can supply two large automatic vacuum installations fitted with *Speedivac* 1SC450 pumps displacing 15 cu. ft. per min. The single pump version of this unit is stated to be capable of serving up to 50 points and can provide a vacuum of between 1 and 10 mm. Hg. with a quarter of the points open at once. The pump is connected to a large vacuum reservoir and is equipped with manual and magnetic control valves and a vacuum switch which enables the pump to cut into the system when the vacuum in the reservoir falls below a predetermined limit. The vacuum tank is $3\frac{1}{2}$ ft. high and $1\frac{1}{2}$ ft. in diam.,

and when mounted adjacent to the pump the complete outfit requires a floor space of approximately 4 ft. × 1½ ft.

For larger laboratories or where a number of floors are to be served, a two pump version of this outfit is available which will operate between 100-150 vacuum points, again supplying a vacuum of between 1-10 mm. Hg. with approximately a quarter of the points open at once. Two *Speedivac* 1SC450 pumps are employed pumping the same type of cylindrical tank which, in this case, is mounted horizontally on angle iron framework with the pumps side by side underneath. The two pumps are connected and the system is complete with both manual and magnetically operated control valves and the vacuum control is regulated by two vacuum switches. The customary procedure for this type of automatic unit is for one switch to be set at a low vacuum such as 10 mm. Hg, and the other at a higher figure such as 50 or 100 mm. Hg.

Initially both pumps are in operation and the tank, which has a capacity of approximately 6 cu. ft., can be evacuated to below 10 mm. Hg when both pumps will cut out. As soon as vacuum points come into use, the vacuum will eventually rise to over 10 mm. Hg and the first pump will cut in until the position is retrieved. However, if the number of points in use is increased, the pressure will continue to rise until 50 or 100 mm. Hg is reached, when the second pump will also cut in and with both pumps operating the position is quickly rectified.

A remote control device is fitted to the unit so that the duties of each pump can be alternated to ensure equal wear. The floor space required for this double pumping unit is 2 ft. × 5 ft. and it is 4½ ft. high.



**QVF glass trap under a sink with glass waste pipes leading away from it.**

## Glassed Steel and Glass Pipes

▶ The borosilicate glass lining of Pfaudler glassed steel pipes is claimed to be resistant to all acids, except hydrofluoric, up to 350°C. However, phosphoric acid at high temperatures and concentrations needs cautious handling. Caustic alkalies can be handled cold or hot up to *p*H 12.

Enamelled Metal Products Corpn. (1933) Ltd., who make these pipes, point out that they obviate corrosion, metal contamination and catalytic action and that they ease the problem of sterilisation and cleaning.

The glass used is resistant to thermal shock. Bond strength of glass and steel is in the order of 10,000 p.s.i. Because glass is brittle and has low tensile strength the lining process is carried out so that it is under compression at normal temperatures. This improves thermal and mechanical shock resistance. The steel can be strained beyond the yield point before glass fractures.

Many corrosive slurries can be handled without risk of abrasion; glassed pipe has also been used for sand slurries.

Sizes range from 1½ in to 12 in. bore. A full range of bends, tees, crosses, reducers, etc., is available. All pipes and fittings have loose, split backing flanges to facilitate lining up. *Fluon* sheathed gaskets are standard for chemical duty. The pipes can be steam or water-jacketed and glassed pipeline valves are available.

▶ Q.V.F. *Visible flow* pipelines are made of borosilicate glass which has good heat-resisting qualities due to its low linear coefficient of thermal expansion, (0·0000032 per °C.). While strong enough to withstand everyday handling borosilicate glass will stand up to the thermal shock of flushing alternately with boiling liquids and ice-cold water.

Liquids and gases in the pipes are visible, and a check can be made on their clarity and colour, and on any crystallisation. Blockages can be located and cleared easily. An additional advantage is that glass is easily cleaned.

Because of their volume and corrosive nature liquids used in technical laboratories are difficult to contain in a pipe. To overcome these problems Q.V.F. have developed a system of glass waste-lines and sink traps. The glass produced by Q.V.F. is extremely flexible, permitting additions and subtractions to the installation. Friction within the smooth glass bore is negligible and no scale forms. Several systems are used to trap effluent from sinks employing either individual glass traps for each sink or traps serving several sinks simultaneously. The waste

**Condenser made in ICI titanium and fabricated by Marston Excelsior Ltd.**

fluid is then conveyed entirely by glass pipeline from sink to point of drain. One recent installation of this type employed over a mile of glass pipeline.

## Stoneware Pipes

▶ Hathernware acid-resisting stoneware pipes are made with a special ceramic body, thoroughly vitrified at high temperature to give a strong pipe of very low porosity which is inert to practically all industrial chemicals. The only notable exceptions are hydrofluoric acid and certain hot strong caustics. The manufacturers, Hathernware Ltd., claim that the pipes do not depend upon the glaze for their resistance to corrosion, they are acid-proof right through the body.

The following types are produced:

*Spigot and socket:* Used for carrying corrosive liquids and for acid-effluent drains and fume ducts.

*Conical flanged:* Used on pipelines subject to pressure, such as pump delivery lines or where the use of putty or mastic for joints is not advisable. Conical flanges are the strongest kind of stoneware flanges. They are held together by split iron collars.

*Metal flanged.* Stoneware pipes with cemented-on metal flanges. These pipes can be made up to required lengths from stock pipes.

*Armoured.* Stoneware pipes with armouring of cast iron or steel. Used for conveying corrosive liquids under difficult conditions of high pressure, vibration, rough mechanical usage or rapid heat changes.

***Fibresin armoured.*** The most recent development in armouring stoneware pipes is to wrap with glass fibre and resin under Hathernware registered trade name ***Fibresin***. This gives a strong, tough and light-weight covering which protects the stoneware from damage during installation and operation. It insulates against thermal shock and is resistant to many corrosive agents.

▶ To overcome certain disadvantages associated with both "spigot and socket" and "conical flanged" pipes, an improved method of coupling has been introduced by the Royal Doulton Potteries. This method employs butt-ended pipes with ground end faces coupled together by means of bolts passing through metal flanges permanently secured to the ceramic pipes. There is no change of section in the stoneware or porcelain which might lead to weakness, a risk which may arise with the older types of joints; pipes can be cut from random lengths and ground exactly after firing, which cannot be done with conical flanged pipes, and the form of construction of the metal causes them to grip the whole circumference of the pipe evenly through the special jointing compound used to hold the flange in position.

Flanges are normally supplied in a light alloy material, but malleable iron can also be used. The holes are drilled to British Standard dimensions and the flanges can either be fixed rigidly in position or made in two pieces so that the drilled portion swings circumferentially round the boss for ease of alignment of bends and junctions. Lengths can be cut and flanges fixed on site if necessary.

When ground stoneware joints are used it is usual to insert a washer between the faces; it has been found that satisfactory joints can be made with many materials, such as rubber, P.V.C., asbestos, P.T.F.E., etc., according to the duty for which the particular pipeline is required.

Standard 45° and 90° bends, and bends of any angle, can be made; also "T" and "Y" junctions, crosses, reducers, expanders, blanking caps and other special pieces. Stoneware cocks can be fitted with flanges of matching sizes and expansion joints can also be arranged when required.

Pipes are normally manufactured in two different ceramic bodies, one white and other one grey in colour. The white material is used when the temperature range is ambient to about 60°C., depending on the size of the pipes concerned. The grey material is suitable for use at higher temperatures than the white and where temperature fluctuations are to be expected.

The fixed flanged pipes are stated to be particularly suitable for operating at pressures of up to 100 p.s.i., and will withstand a reasonable amount of vibration in operation.

## Bi-Metal Tubes

▶ In plant such as heat exchangers, where tubing is attacked inside and out by different corrosive media, bi-metal tubes are finding wide application. Talbot-Stead Tube Co. Ltd., who specialise in the manufacture of bi-metal tubes, make the inner and outer tubes of metals which resist the different media involved and draw them together to make the tubes. For instance, to cope with service in ammonia refrigeration plant, tubes are made of copper and steel—the copper is in contact with cooling water and the steel with ammonia.

Bi-metal tubing is said to give improved heat transfer rates because it remains comparatively free from corrosion and slime, which naturally reduces cleaning and maintenance costs.

Ordinary boiler tubing has been replaced by bi-metal tubes in which the hot gases pass through on the steel side and boiler water surrounds the copper side.

It is also possible to prevent galvanic corrosion with bi-metal tubes.

## Titanium Pipes

▶ Largely because of its corrosion resistance in a wide range of aggressive media, titanium is being increasingly used for making or lining chemical plant and equipment.

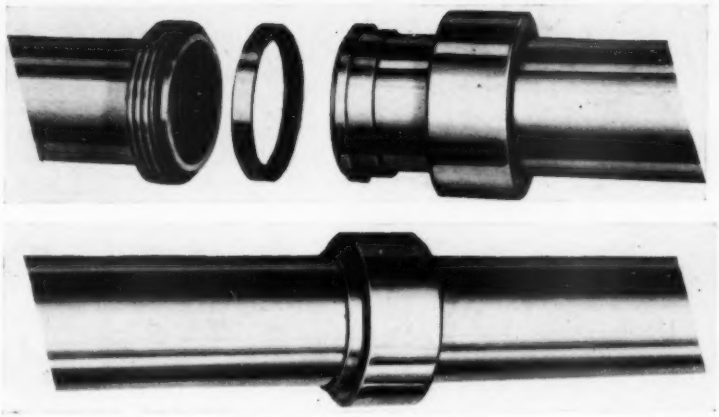
One of titanium's outstanding attributes is high resistance to pitting and stress-corrosion cracking in chloride solutions and other liquids.

I.C.I. Metals Division is now devoting considerable attention to methods of producing titanium tubing in a suitable range of sizes for chemical pipework. In sizes up to 2 in. bore by, say, 20 s.w.g. wall thickness, titanium tubes are normally supplied solid drawn. This range is being extended; beyond it, tubes are fabricated by forming and welding titanium strip.

Both types of tubing are very ductile, and bending to form coils for condensers, heating and cooling coils, etc., requires no special techniques.

Where economic conditions dictate the use of a thin-walled titanium tube, support may be provided by backing the titanium with mild steel. In vacuum conditions it is necessary to have a firm bond between the titanium and the backing material. To meet these requirements, Marston Excelsior Ltd., a subsidiary of I.C.I., has developed a thermosetting resin (*e.g. Durestos*) to provide mechanical backing to a thin titanium lining. The cost

**The Royal Doulton Potteries supply this fixed flanged ceramic piping in white or grey.**



**APV stainless steel pipe fittings, type S.P. for semi-permanent in-place cleaning.**

of titanium backed with *Durestos* or glass-fibre laminates compares favourably with that of titanium-lined mild steel.

The use of components made from titanium in trouble-spots can reduce shut-down time and maintenance costs. Reduced manufacturing costs may result from faster processing at higher temperatures than are possible with conventional materials.

With plant specially designed to incorporate titanium, it is now possible to handle certain corrosive chemicals and to carry out certain chemical processes not hitherto possible on an industrial scale. In using titanium, the absence of contaminants, which are normally produced by corrosion, makes possible new reactions and products.

## Epoxy Resin Lined Pipes

▶ The Staveley Iron and Chemical Co. Ltd. offer spun iron pipes and special castings in all sizes lined with chemical-resistant epoxy resins. Cast iron pipes may therefore be adopted for special duties where corrosive fluids are to be piped or where contamination of products is to be avoided.

The lining process comprises the application of priming, body coats and finishing coats and produces a film of non-toxic epoxy resin which is abrasive resistant. Pipes lined in this way are tested electrically to ensure freedom from discontinuities.

The Staveley pipe lining has a chemical resistance similar to that claimed for epoxy resins. In general, epoxies are more resistant to non-oxidising acids than oxidising acids. The lining is said to be satisfactory for hydrochloric acid in all concentrations up to 100°C. In sulphuric acid it is reported as being suitable for strengths up to 60% at temperatures up to 100°C. and up to 95% at temperatures of 25°C. It is particularly recommended for alternative acid and alkaline conditions and will withstand alkalies of all strengths, at temperatures up to 100°C. It can also be used for carrying petroleum and organic solvents.

The range of spun iron pipes has been extended by the production of spun iron flanged pipes which are lighter and have a higher flow capacity in each size than the conventional " cast-on " flanged pipe.

The latest addition to the range of joints is the Tyton flexible joint which has one component only—a rubber gasket, which is quick to assemble.

## Plastic Hose

▶ Dispersion polymer PTFE hydraulic hoses are now being marketed, as *Palmer Fluoroflex*, by Palmer Aero Products Ltd. They are available with swaged-on or re-useable end-fittings.

These assemblies, constructed from a new fluorocarbon resin compound with exterior stainless steel wire braid, will carry a wide range of engineering solvents, hydraulic fluids, acids, and H.T.P., and are said to have good chemical, physical, thermal and electric properties. They are claimed to be unaffected by all chemicals except molten alkali metals and fluorine at elevated temperatures and pressures; to operate in pressure-ranges from 1000/10,000 p.s.i.; to withstand temperatures from −100°F. to + 500°F., to be non-ageing, non-flammable, water repellent and to withstand prolonged flexing and vibration.

The new units were designed by the company to supplement its range of *Silvoflex* hose assemblies.

▶ A polythene-lined flexible rubber hose for the conveyance of liquid foodstuffs, wines and spirits has been developed by Dunlop under the trade name of *Valithene*. It is available in sizes ranging from ½ in. to 3 in bore, and lengths of up to 60 ft. can be supplied. Working temperatures should in general not exceed 60°C., although very low-pressure steam may be used for cleansing, provided that the other end of the hose is open to the atmosphere. Maximum working pressure is 50 lb. p.s.i.

## Stainless Steel Fittings

▶ Where pipelines are frequently dismantled for washing and sterilising the fittings must be disconnected easily. The A.P.V. Co. Ltd. produce stainless steel pipe fittings in their *S.P.* and *R.J.T.* ranges. Both are of the expanded union joint type in which the unions are expanded on to suitably cut lengths of pipe, on site, to provide " tailor-made " pipelines, without the need for brazing or sweating of joints.

" *S.P.* " *sanitary pipe fittings.* The union consists of a male part and liner which are expanded on to accurately squared pipe ends, a seal ring and a nut. The key piece of the union is the seal ring—a flanged rubber ring bonded to stainless steel and tapered so that, when compressed by the spigots on the pipe ends, it provides a flush seal without crevices. The male and female pipe ends have accurately machined spigots which locate the seal ring concentrically and laterally. They compress the rubber seal ring until they bear on the stainless steel faces so that there is no overtightening and consequent restriction of the pipe diameter.

Round or hexagonal nuts are available as alternatives, the round type preventing any unauthorised dismantling since a special type spanner is required to grip it.

The resulting union is simple, strong and sanitary and is particularly suitable for the applications of in-place cleaning.

" *R.J.T.* " *pipe fittings.* The ring joint union, introduced by A.P.V., is now the British Standard for sanitary pipelines. It consists of a flanged liner and a male part, between which a round section rubber ring is compressed by tightening a nut. The seal can be made leakproof without the use of spanners. The simple design of the union and its freedom from crevices is reported to make sterilisation extremely simple.

Both *S.P.* and *R.J.T.* type fittings are made in sizes from 1 in. to 3 in. and are supplemented by standard ranges of tees, bends, cocks and ancillary fitments. Special tools for expansion of unions are supplied on loan by A.P.V.

*Cast,* " *Forging quality* " *fittings.* A recent development by A.P.V.-Paramount Ltd., the associate foundry company of A.P.V., is a range of cast, stainless steel pipe fittings. They are made in sizes up to the large-diameter bores required for petroleum and chemical engineering applications, and are designed for the welded construction of pipelines and, although exhibiting the cost advantage of a casting, are of forging quality.

## Protective Tapes

▶ A recent development of the Minnesota Mining and Manufacturing Co. Ltd., in pipe protection, is the introduction of *Scotchrap* pipe primer. This is a low viscosity quick drying rubber-resin based primer used for coating metal pipe surfaces under severe moisture conditions or where a pipeline is to be permanently under water. It absorbs moisture and evaporates it with solvent during the drying period.

Where pipes are not already sufficiently dry or clean to receive a protective coating material, the application of this pipe primer is said to provide the surface necessary to ensure adhesion of *Scotchrap* PVC pipe-wrap tape. Coated with a pressure-sensitive adhesive on one side, this tape is formulated with a built-in corrosion inhibitor to protect pipelines, cable and various metal surfaces from weather, chemical or electrolytic corrosion.

Its resistance to acids, such as sulphuric, hydrochloric, phosphoric and other corrosive materials, such as compounds of chlorine, bromine, sodium and lithium, makes the tape suitable for the protection of above-ground or buried pipes in manufacturing plants in the chemical and pharmaceutical industries. It is also claimed to be resistant to sunlight and general weathering conditions.

*Scotchrap* may be used for the complete coverage of all buried pipelines, especially where tests show soil resistivity to be low or where chemical corrosion is likely to occur.

The 3M Company manufactures two types of *Scotchrap*: No. 50 (10 thou thick), which is used where easy conformability to odd shapes and contours of joints and fittings is of prime importance; and No. 51 (20 thou thick), tough but flexible tape, which offers a high insulation and maximum protection from abrasion.

▶ Industrial Tapes Ltd. market *Speedfix* pipe protection tapes which are said to be insulating and resistant to acids, alkali, fungus and bacteria. Life from 30 to 40 years underground is expected from these tapes.

They are made to give a high degree of conformity to angles and to irregular surfaces.

There are two kinds, No. 1 quality being 0·01 in. thick and No. 2 quality being 0·02 in. thick. The tapes are put up in reels of 100 ft. in widths from 1 in. to 2 in.

Pipe lagging machines for use with the tapes are also marketed by Industrial Tapes Ltd. These have a quick acting and self-centring gripping device so that once locked in the required position the lagging is carried out with the exact amount of overlap required throughout the length of the run. There are several models for varying pipe diameters and also for lagging before and after installation.

**Scotchrap PVC pipe wrapping tape is claimed to be resistant to many corrosive materials and is applied to pipes both above and below ground.**

## Pipes Heating by Electric Tapes

▶ To keep fats, oils and many chemicals fluid, it is necessary to avoid heat losses in pipe runs containing these materials. An unlagged 1 in. bore pipe through which liquid flows at 90°F. above ambient temperature will give off to its surroundings as much as 61 B.Th.U. (equivalent to 18 watts), but ½ in. of good thermal lagging applied over the pipe will reduce that heat loss to 9 watts per ft., and 1 in. lagging to 6 watts. Any further increase in lagging thickness is, however, governed by the law of diminishing returns and will not bring about much further improvement. The method of choice is therefore to compensate for heat losses by other means, one of which is electric pipe tracing.

Isopad Ltd. make electric heating tapes from glass fibre and electrically insulated resistance wire. Standard lengths range from 36 in. to 200 ft. and various standard loadings between 10 and 40 watts per ft. of tape. Each Isotape represents a complete electrical circuit terminating at one end, which allows quick installation.

For frost protection, a PVC heating tape of 5 watts per ft. loading is made in various lengths between 8 ft. and 240 ft. Higher temperatures as well as heating duties (as distinct from compensation for heat losses) are catered for by complete heating units known as Isojackets which comprise a hinged metal shell containing thermal lagging and the actual heating surface.

## Pipe Cleaning Processes

▶ Vacu-Blast Ltd. have developed and patented equipment and a technique for cleaning the internal surfaces of tubes and piping. It is claimed that a small range of simple attachments enables any shape or size of tube from ⅛ in. bore upwards to be cleaned.

The essential part of the equipment is the Vacu-blast machine which incorporates a pressure/vacuum system for abrasive feed and recovery with a thorough segregation of grit, slag and dust adapted for tube cleaning.

The tube replaces the Vacu-blast gun with the pressure and vacuum hoses connected at opposite ends, the closed circuit being maintained within the tube body. According to the varying sizes of tube, different methods are employed. With tubes of ⅛ in. bore the blow-through method is used, but the cross-sectional area of the subject items must be greater than the area of the blast nozzle. Usually a nozzle of $\frac{5}{16}$ in. bore is used and to conform with the above stated requirements, tubes of ⅛ in. bore are nested to give a cross-sectional area upwards of 0·077 sq. in. or seven ⅛ in. bore tubes. A simple adaptor is made to nest these tubes and the Vacu-Blast nozzle is offered to this adaptor which acts as a distribution box for the abrasive. In this manner back pressure is avoided and the blast stream continues throughout the length of each tube.

Tubes in the range of bore sizes ½ in. to 2 in. may also be cleaned on the blow-through principle, but the nozzle is now offered direct to the mouth of the tube. Above this size the nozzle can be entered into the tube and traversed right along the work surface. The usual method is to pass the nozzle to the far end of the tube and then switch on the blast stream by means of a foot switch, withdrawing the nozzle slowly whilst blasting is in progress.

Larger bore tubes in the approximate range 3 in. to 8 in. are cleaned in a similar manner, but the greater surface area may require one of three different attachments to clean certain parts. Amongst these attachments it is most probable that the supersonic nozzle or parallel bore nozzle will clean 80 or 90% of the surface area, but the odd 10% will necessitate use of the angle nozzle. This nozzle directs abrasive at 90° to the longitudinal

axis of the blast hose, thereby securing impingement of the abrasive normal to the work surface. Such treatment is frequently necessary at the inner bend of tubes which have been packed with sand and heated prior to forming, as at this point there is likely to be a high incidence of fused sand and there will be a considerable amount of heat scale. When tubes above 8 in. bore are cleaned it is advisable to facilitate passage of the blast hose by the introduction of a spider attachment to centralise the nozzle in the tube.

In addition to the simple attachments mentioned above, a more specialised item has been developed for cleaning large bore straight tubes. Known as the rotary head, it comprises two rotating blast nozzles driven by an air motor. The assembly is mounted on a carriage and is drawn through the tube while blasting is in progress.

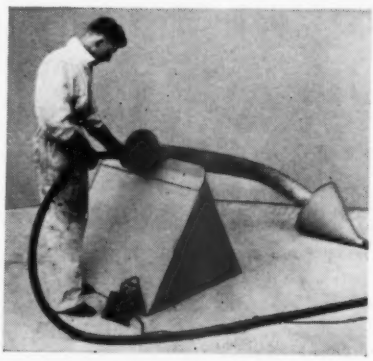
This particular item is, it is said, well suited to the cleaning of straight tubes in the range 10 in. bore to 24 in.

▶ General Descaling Co. Ltd., carry out the acidisation or pickling *in situ* of chemical plant and pipework.

The fully mobile equipment for the purpose comprises vehicle-mounted pumps capable of circulating hot degreasing, pickling and passivating solutions at a rate up to 100 gal. per min. and against total heads of up to 160 ft. at this flow rate, portable heated solution tanks of capacity of up to 10,000 gal. mixing facilities and chemical control facilities.

Using this equipment it is said to be possible to obtain chemically clean plant without resorting to offsite or pre-erection pickling or shot-blasting.

**Speedfix tapes for pipe protection conform smoothly to angles and irregular surfaces.**



**Vacublast equipment for cleaning pipes.**

**Isotapes applied to pipe runs. For many applications straight tracing is sufficient.**

By making this acidisation technique part of the plant commissioning procedure further contamination may be avoided. Acidisation is a relatively rapid procedure, for the powerful equipment and readily adaptable flexible feeds available allow the most complex plant to be cleaned, often in one set-up, using suitable multiple solvent feed and return pipes, while the use of high-pressure chemical hoses allows the equipment to be placed at a safe distance from any plant or, if required, outside a building. Pumps are diesel driven but flameproofed for working in most areas.

This new technique has been developed primarily for the oil and steel industries (pickling hydraulic and lubricating circuits), but has been found to have a wide application in the chemical and nuclear power industries.

**For further information on the items in this review use the Enquiry Coupon in this issue.**

## Industry's Publications

**Monsanto Mail.** A distinguished newcomer to the swelling ranks of house magazines has been issued under this title by Monsanto Chemicals Ltd. Sir Miles Thomas, Monsanto chairman, who was once a journalist himself, writes the introduction and features in a discussion on the present status and future of Britain. Other articles deal in an unusual and "human" way with some of Monsanto's products. The journal is lavishly illustrated and handsomely printed. W. D. Garner is editor.

**Terylene for filtration.** Terylene is widely used for filtration. The Fibres Division of I.C.I. have issued this little booklet in which with graphs they describe the effects of various reagents upon this fibre.

**Solvents standards.** The British Standards Institution has issued eight further standards in the series for solvents and allied materials:

Di-*n*-butyl phthalate (B.S. 573 : 1957)
Carbon tetrachloride (B.S. 575 : 1957)
Diethyl ether (technical) (B.S. 579 : 1957)
Tritolyl phosphate (B.S. 1999 : 1957)
*o*-Dichlorobenzene, Grades A & B (B.S. 2943/4 : 1957)
Formaldehyde solution (B.S. 2942 : 1957)
Paraformaldehyde (B.S. 2941 : 1957)

Four of these are revisions of earlier standards—B.S. 573, 575, 579 and 1999 (the first two having been published in 1950, the others in 1951 and 1953 respectively); and they now reflect improvements in the qualities of material currently available.

The two standards for *o*-dichlorobenzene are published in one volume. They specify two qualities of material, the first being substantially free from other isomers and suitable for the synthesis of organic chemicals, and the second quality normally containing appreciable proportions of *p*-dichlorobenzene, as suitable for insecticidal purposes, for use in cleaning compositions and for the manufacture of certain intermediate products.

The standards of formaldehyde solution and paraformaldehyde deal with materials of reliable quality for use in plastics and chemical manufacture generally.

Copies of these standards may be obtained from the B.S.I., Sales Branch, 2 Park Street, London, W.1. B.S. 573, 575, 579, 1999, 2942 and 2941, price 4s., and B.S. 2943/4 (two standards under one cover), price 4s. 6d.

# The Partnership of Science and Business

## SIR ALEXANDER FLECK'S PRESIDENTIAL ADDRESS

**The advancement of science can only be achieved with the resources which business can provide and, if business is to provide them, then it must bring science to its aid. The chairman of I.C.I. made this the theme of his address at the opening of the B.A. meeting on August 27. Here is the essence of his case for a partnership of science and business.**

THE total annual research expenditure in this country alone is estimated to be £300 million. Public expenditure on education (including the Universities) is now some £740 million a year; if our Universities are to grow large enough to accommodate everyone who could benefit by such an education, instead of merely the 3½% of the population who enjoy it now, then we shall need to contemplate spending something nearer £1,200 million a year. These are large sums and if as a nation we are to stay solvent they can only come from one source, the wealth which we produce.

In this context it is easy to see the importance and responsibility of business, which produces and distributes most of our national wealth. . . .

### Three functions of business

I venture to put forward three characteristics which I think a business should have if it is to survive and function effectively over a period of years.

(*a*) First, it must contribute to the well-being of the community and its social evolution. I believe it can best do that in three specific ways: by producing goods or services for the community at fair prices; by giving fair treatment in the way of remuneration and working conditions to all who give their services to the business, whether as pay-roll employees, administrators or scientific staff; and by giving a fair return to those who risk their money in the business, so that, apart from this consideration, they will be encouraged to provide again for further ventures. When business takes on itself the deployment of financial, material and human resources, it also takes on, I believe, the responsibility for seeing that they are properly and effectively used. In other words, it has an obligation to the community; and only in so far as it fulfils that obligation does it contribute to the well-being of the community and justify its own existence.

(*b*) Second, business must have the capacity to change its methods and if necessary even its objectives. It must be constantly alert to see that its products or services meet or anticipate the needs of the public, and to withstand the nipping and eager air of competition whether it comes from advancing techniques or from new entrants into the field.

(*c*) Finally, if it is to be self-perpetuating through growth or modernisation, a business must dispose of its products or services for more than their cost—or in plain language, it must make a profit. That is true of business whether run by private enterprise or by the State; nor does the political system of the State make any difference to the validity of this notion. Only from the excess of income over expenditure can we finance the expansion of business and science. . . .

### The scientist in the business structure

I should now like to examine how a balanced partnership can be achieved in practice, by considering the place of the scientist in the business structure. . . .

**Research.** This has been called the life-blood of industry, but I prefer to liken it to the pituitary gland which, I am told, after doing little that is obvious for several years except consume nourishment, at length stimulates other parts of the organism to develop and makes it capable of production.

Research applied to business can take different forms, and I think you may be interested in one example within my experience. It began with a research manager's conviction that a new inhalant anaesthetic was needed which should have the following properties: it should be a volatile liquid, with high anaesthetic potency, and be free from toxic, explosive and fire hazards. These criteria, he argued, pointed the way to aliphatic halogen compounds containing little hydrogen and especially to compounds with two or three fluorine atoms on the same carbon atom—groupings which are known by organic chemists to be not only unreactive in themselves, but also to strengthen neighbouring carbon-halogen bonds. The resulting inertness is one of the factors in avoiding toxicity; and the use of fluorine rather than other halogens keeps the volatility high. He also proposed a new method of expressing dosages which made it possible to relate, by using a principle of chemical thermodynamics, the amount of anaesthetic in the inspired air to that in the body fluids. This helped in the selection, for biological testing, of compounds likely to have the desired potency, among which the one finally chosen was 2 - bromo - 2 - chloro - 1 : 1 : 1 - tri-fluoroethane, a new compound synthesised specially for the purpose.

The major research effort, which for the first two years fell to the organic and physical chemists, had at this stage passed to the pharmacologists, whose screening tests took some three years. They showed that the new compound had not only the properties sought, including a high margin of safety from overdose, but also some unexpected advantages. Clinical trials with successful results began six years after the research started, and meanwhile manufacturing methods were developed by chemists and engineers, leading to general release to the medical profession two years later.

There are several features about this much abbreviated story, some of which are relevant to my present theme. It illustrates, first of all, the systematic application of pure scientific principles to a desired and well-defined end which, though primarily commercial, is not without social implications. Second, the research threw light on the physicochemical basis of anaesthesia, which time, if no other reason, forbids me

to enlarge upon. Third, success was crucially dependent on the existence of a team of specialists in several scientific disciplines and also in the somewhat recondite technology of fluorine; notwithstanding these favourable circumstances and adequate financial backing, the research and development took seven years. Fourth, the distinction between the research and the development function of business is brought out: the original synthetic and early testing work was research, while the development consisted of devising suitable methods of manufacturing and launching the chosen compound, and of studying its clinical effect. . . .

**Production.** The production or operation function includes the application of technical methods often according to a routine, though it also demands much planning and organisation. Although such work is sometimes considered humdrum and repetitive compared with research and development, it is often essential for it to be done by highly qualified technical men. It is just as great a mistake to believe that unqualified men who come up what used to be called "the hard way," are generally adequate, let alone best for production work, as to hold that good technical people are wasted in such jobs as plant management. On the contrary, they must be encouraged to regard it as an interesting and necessary part of their training for higher management. . . .

**Sales.** On the commercial side also, scientists may be needed in sales, sales service or purchasing, to achieve the best results for a business making technically complex products. I cannot agree that employment of technical men in commercial departments is necessarily wasteful: it gives flexibility within the business, and can often ensure smoother co-operation when a works manager or research chemist feels that his own, the technical point of view, is understood by a man in one of the commercial departments; moreover, as training for higher administrative posts, commercial experience is invaluable to the scientist.

**Administration.** When he reaches such a post, the scientist, recognising the value of science in business administration, will be well placed to exploit it. I am not thinking here only of new equipment in the office, such as electronic computers or apparatus for sensing letters and

**Sir Alexander Fleck,** *F.R.S., is particularly well qualified to speak authoritatively about the partnership of the scientist and businessman for he is both himself. Chairman of I.C.I. since* 1953, *he reached this outstanding position in British industry after a struggle that began when he went to Glasgow University—as a lab boy. By great determination he gained a chemistry degree at* 22 *and later a doctorate. During the first world war he went to the Castner-Kellner Alkali Co., which became a subsidiary of Brunner Mond, one of the companies which merged to become I.C.I. in* 1926. *Within five years of the merger Fleck was Managing Director of the General Chemicals Division. In* 1944 *he went on to the I.C.I. Main Board. He is* 69.

figures; science has more to offer than mere tools. It offers the whole philosophy of the scientific approach to the problems of management. I need only remind you of some of the steps involved: definition of the problem, observation and collation of the relevant facts, formulation of a hypothesis or principle, its testing and its general application.

This approach has been of untold value in the examination of human activity and its measurement, which is usually described as work study. It has also been very successfully employed in the problems of supply and distribution, in adjustments of stock levels and in planning of delivery programmes.

All the same, it is worth noting that an otherwise successful application of such techniques can founder on the inability to handle human relationships with proper understanding.

**Finance.** No technological business ever attempts to progress without continually seeking financial advice. However, I have failed to see in this country an equal acknowledgment that financial institutions need to take the benefit of continuing technological advice, though I am glad that some progress is being made in this direction overseas. For example, I know of a bank especially interested in natural resources which employs full-time geologists. Again, the World Bank organisation in Washington employs technical men not only at Headquarters, but also to carry out specific missions in various countries. Finance and technology will, I hope, become more and more interdependent as our businesses adapt themselves to current needs.

There is scope then for the scientist to infiltrate throughout almost the whole business structure. That being so, it is pertinent to ask, if scientists are to play an important part in business administration, is the balance between science and business likely to be upset? The answer to this question is, I think, threefold.

First, as British industry is at present constituted, the balance is heavily tilted the other way. That is to say, there are still many enterprises which are not employing qualified technical men even in tasks where one would expect to find them, and conversely there are no industries that appear to be harmfully dominated by scientists. This is due partly to the shortage of scientists and technologists with which we are all familiar, but partly also to historical circumstances. In the nineteenth century, due to this country's wealth of practical engineering experience, theoretical knowledge was undervalued. At the same time, an educational bias towards the classics, based on an aristocratic tradition, sometimes led the second and third generation of a manufacturer's family to forsake the business altogether for politics or the bar, or if not, at least to be quite unfamiliar with the value of science. Again, as we have seen, in some concerns scientists are relegated to the position of advisers to management and are allowed little part in the active control of the business.

Second, in businesses where scientists rightly play a prominent part in administration, non-technical men who nevertheless have a good understanding of scientific principles, are with advantage sometimes put into semi-technical jobs, and this helps to maintain a balanced partnership.

Third, and most important, the

balance that we seek must come in great measure from within the individual himself, a balance provided by the education which the scientist and the non-scientist ought to receive. This, besides being central to my theme, is very much the personal concern of many of us here.

**Balance in education**

There are three senses in which we might consider balance in education. The first arises from two different conceptions of the purpose of education. On the one hand there is the formation of character, and the development of intellect and personality. At the other extreme is the concept which I suppose finds its most powerful expression in the educational philosophy of Soviet Russia, that the purpose of education is to provide useful members of society in which the desires of the individual must be subordinated to the needs of society.

I do not believe that these two concepts are wholly conflicting nor that the second runs completely counter to the British tradition of individual liberty. A balanced educational system should have room for both. The striking successes achieved by the Russians in science and technology are directly attributable to a system of education deliberately designed to produce large numbers of technically trained men and women with the ability to increase the economic power of the country through industrialisation. To this end they established a strong teaching profession to which recruitment is no problem because it enjoys the highest pay and status of all the professions. Though undoubtedly state direction still has a place in the Russian educational system, its purpose is being achieved to an increasing extent by incentives.

We are proud that our Universities, despite their growing financial dependence on the state, still retain their academic independence intact. Nevertheless, they have quite properly reacted to the stimulus of the country's needs which have led the older Universities, for so long the home of the humanities, themselves to enlarge their science faculties. The new St. Catherine's College at Oxford and Churchill College at Cambridge will give particular prominence to the study of science. The introduction of transfer scholarships to enable promising arts men to turn to science, has been readily accepted. More sixth-formers are reading science in Public and Grammar Schools. Some long-term financial incentives may operate here, but more important has been an intensive propaganda effort which I hope will be sustained by this Association's programme for organising lectures up and down the country. . . .

This brings me to the second sense in which I refer to balance in education. I am thinking here of the need for those who study the humanities to have some understanding of the workings of science, and for our scientists to widen their horizons by relating their science to its human context both historically and in terms of the present day. . . . The qualities of mind which, for instance, are fostered by studying chemistry and history are very much alike. Both chemists and historians must cultivate an inquisitive and acquisitive mind. . . . Both must be imaginative, the chemist in advancing hypotheses to predict the future, the historian in doing so to explain the past.

The merits of a balanced curriculum are recognised in Soviet Russia, where children between 11 and 17 devote something like 46% of their working hours to science subjects, with the emphasis predominantly on mathematics, and another 46% to what we call arts subjects, with the emphasis here on Russian language and literature. Clearly a correct balance can never be achieved with premature specialisation, which the current demands for entry into many Universities impose on our most talented students.

There is a third and final sense in which I refer to balance in education. I have said that we demand, from our scientists and non-scientists alike, intellectual qualities, such as curiosity, judgment and imagination. Equally we want our young people, whatever their branch of study, to possess high qualities of character. I need not enlarge on this theme except to say that the society which a balanced partnership of science and business can help to build, will as always call for courage, integrity and tenacity. These are some of the ideals that we might have in our minds, as we each address ourselves to the problems of education for an age of science.

## A National Chemical Centre

To The Editor.

Dear Sir: In "Topics and Comments" (Manufacturing Chemist, July 1958, p. 270) you express interest in the desirability of a single national society to embrace the activities of the Chemical Society, the Society of Chemical Industry and the Royal Institute of Chemistry.

There would no doubt be many hurdles to clear in the achievement of such a merger, but we are sure that the objectives would be worth while. Perhaps we could look forward to a Chemical Centre with a comprehensive library, large and small lecture theatres, scientific film, microfilm and microcard projection units, and space for social gatherings. Many of us know only too well how we have to hire larger premises for distinguished and popular lecturers; that our library facilities are inadequate due to lack of available space, and that there is a measure of duplication in the journals connected with the three societies.

Apart from the desire of some members to retain the individuality of the respective societies, the main initial problem would undoubtedly be a financial one. Would it not, therefore, be worthwhile to have a committee formed from the existing societies to consider this problem, including the possibility of setting up a Chemical Centre?

We feel that if the initial financial aspects could be solved, a large majority of the chemical profession would welcome such a merger, for all of us realise that the facilities of yesterday are not only inadequate for today, but will become even more inadequate in the future.

D. O. Holland (ph.d., f.r.i.c.)
D. S. Morris (ph.d., f.r.i.c.)
*London.*

**NRP Nomogram.** Products of the Nederlandse Raffinaderij Van Petroleum-producten of Haarlem, Holland, include petroleum jellies, white mineral oils, microscrystalline waxes, and sulphonates. They have published a nomogram as a guide to viscosity, temperature, and specific gravity conversion. Copies can be obtained from their agents, Arthur Brown and Co. Ltd., London, E.C.3.

# Wetting Agents for Agricultural Sprays—2

By J. S. Stanley, PH.D.*

**In the first of these articles, published in our August issue, the fundamental work on wetting agents in agricultural sprays was reviewed, recent research having given a fairly clear picture of what happens when a wetting agent is added to a spray. In this second article, it is shown how the results of this fundamental work may be applied to specific spraying problems, and an attempt is made to assess the suitability of some of the many types of wetting agent that are now on the market for inclusion by the spray chemical manufacturer in his formulations.**

### Insecticides and fungicides

IN SPRAYING insecticides and fungicides it is usually necessary to obtain as complete cover of the leaves as possible. This is probably of greatest importance in fungicide spraying, since the spores of fungi are immobile, whilst insects usually move over the surface so that their chances of coming into contact with a lethal deposit are correspondingly greater.[16] Cover is relatively unimportant with systemic insecticides which are absorbed through the leaf cuticle into the sap system, rendering the whole plant toxic to leaf-eating and sucking insects. The object of spraying with these insecticides is to obtain as high as possible deposit, regardless within reason of the evenness of distribution.

In high volume spraying complete cover is not usually attained and is fortunately not necessary even with fungicides.

Butt[17] has shown that the action of the fungicide captan may be exerted through a film of water connecting the fungicide deposit and the fungus spore, and it seems very likely that the fungicidal effect of copper compounds such as Bordeaux mixture depends on their solubility in water[18] so that they will, like captan, exert their effect through a connecting film of water. Butt suggests that a cover of 15% is sufficient to obtain good control using captan.

In high volume spraying the spray liquid must have sufficient wetting power to prevent recession of the spray from the leaf surface. To do this the receding contact angle of the spray on the leaf must be reduced to zero, as otherwise the spray, which initially covered the whole surface, will collect into large discrete droplets which may roll off the leaf. Even if the large drops do not roll off, this recession will lead to poor cover and uneven distribution of the deposit. The receding contact angle is always considerably smaller than the advancing contact angle, so that when wettable leaves such as potato (advancing contact angle 35° [15]) are sprayed there will probably be little recession even when the spray contains no wetting agents. Where spraying is carried out on leaves that are not so easily wetted (the leaves of most fruit trees fall into this category), addition of a wetting agent will be desirable to prevent recession. Somers'[15] recent work on the level of run-off deposits in the presence of various wetting agents, discussed in the first of these articles, is of importance in this connection, since he has found that the sodium dialkyl sulphosuccinates markedly increase the quantity of spray lost through run-off, whereas non-ionic wetting agents have little or no effect. It would therefore seem that the latter would be preferable for use in high volume spray formulations.

When very unwettable crops such as peas are being sprayed, most of the spray will bounce off the surface, resulting in low retention unless wetting agents are added to prevent this. The concentration of wetting agent required to suppress droplet bounce will probably be sufficient to prevent recession of the spray liquid after spraying.

It is often stated that wetting agents will reduce the tenacity and resistance to weathering of the dried deposits. This is particularly important with inorganic sprays such as the copper fungicides whose tenacities are rather low, but is of less importance where oil-based emulsions of such materials as DDT are being used, since the resistance to weathering of deposits of these materials is very good, possibly because they become incorporated in the leaf cuticle.

Although there is no direct evidence on this point, Somers,[19] in a study of the tenacity of Bordeaux mixture, has found that the adhesion of the particles to the leaf is greater than the cohesion to themselves. It is therefore possible that wetting agents, which increase the proportion of the deposit in direct contact with the leaves by increasing the relative cover, will actually improve the tenacity of the deposit and its resistance to weathering. But even if wetting agents reduce tenacity by adsorption at fungicide particle and leaf surfaces, the improvement in evenness of distribution and relative cover that results will more than offset any loss in resistance to weathering. This point, which is of obvious practical importance, in the opinion of the writer requires further study which should yield valuable results.

In low volume spraying and mist blowing no attempt is made to obtain complete cover, the object being to obtain an even deposit over the target area in the form of small discrete droplets.[20] In order to obtain the maximum cover the droplets after impact should spread as rapidly as possible. Wetting agents will invariably increase the rate of spreading even when the advancing contact is low and, as run-off does not occur, the very powerful sulphosuccinate wetting agents would appear to be very suitable for this application.

Miscible oil formulations of fungicides and insecticides usually have good wetting power by virtue

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of the relatively large concentrations of surface-active emulsifying agents that they must contain to give emulsions of satisfactory stability on dilution. Emulsion concentrates, on the other hand, which are stabilised by protective colloids such as glue or carboxymethyl cellulose, may have poor wetting power, since these protective colloids have very little surface activity. Wetting agents should therefore be added to these formulations to obtain adequate wetting. Kearns and Morgan,[21] for instance, recommend the addition of sodium dioctyl sulphosuccinate to a mixed DDT gamma-BHC emulsion for fruit tree spraying.

The suspending agents such as sodium lignin sulphonate, and naphthalene sodium sulphonate-formaldehyde condensates which are commonly used to confer stability to wettable powder dispersions, have almost no wetting power at all. For instance, the surface tension of a 0·2% solution of the naphthalene sulphonic acid-formaldehyde condensate is 55 dynes/cm.[22] A reduction in surface tension to at least 30 dynes/cm. is required to obtain adequate spreading for most applications, so that wetting agents must be used in addition to these suspending agents.

**Herbicides**

Agricultural herbicides must be selective in their action, since it is usually required to kill weeds among a growing crop that must remain undamaged. This selectivity may be obtained by choosing chemicals which are toxic to the weeds but leave the crop plants undamaged. The selectivity of the hormone weedkillers, MCPA, 2,4-D and MCPB, which are widely used for killing weeds in cereals and grassland, is of this type. The grass-killers TCA and dalapon are relatively non-toxic to broad-leafed plants and have been successfully used for the control of wild oats in peas and sugar beet.[23]

Other herbicides depend largely upon physical differences between crop plants and weeds for selectivity. The success of the early methods of weed-killing in cereals with copper sulphate and sulphuric acid depended to a large extent upon low retention of the toxicant by the crop, and also upon the fact that the leaves of the crop can be badly scorched without killing the plant, since the growing point lies beneath the soil. Recent work on the spraying of peas with dinoseb indicates that selectivity is largely dependent upon low retention of the herbicide by the crop. Damage to the leaf cuticle caused by wind and air-borne soil occurred extensively in Britain during the spring of 1955, which was very stormy. This damage led to increased retention of dinoseb and marked scorch.[10] The same workers have confirmed this result by laboratory wind and soil blowing tests.

A third method of obtaining selectivity is by pre-emergence or pre-sowing spraying. This technique is used to control weeds in sugar beet, fodder beet and mangolds with the non-selective weedkiller PCP. Spraying is done after sowing but just before the crop emerges, so that the herbicide, which kills the weeds by scorching, never comes into contact with the leaves of the crop. Weeds may be controlled in tulips and many other horticultural crops by pre-emergence spraying with PCP, CIPC, etc.

**MCPA formulations**

The most important use of herbicides in this country is in cereal spraying. In the major arable areas of the eastern and northern counties between one-third and two-thirds of all the cereals grown are sprayed each year with a herbicide, and on 80% of these the herbicide used was MCPA formulated as sodium or amine salt.[25] It is therefore proposed to consider in some detail the advantages and disadvantages of adding wetting agents to MCPA formulations.

The selectivity of MCPA is mainly chemical in origin and does not depend primarily on differences in retention between weeds and crop. Provided the spray is applied at the correct time very little damage to cereals results even when dosage rates as high as 1·5—2 lb./acre are used, but if spraying is carried out too early, *i.e.* before tillering, abnormalities in growth may result. Cereals are difficult to wet, so that when they are sprayed low retention due to droplet bounce will occur; addition of wetting agents to the formulation will suppress this and result in the crop receiving a higher effective dosage of MCPA. This will mean that there is a greater risk of crop damage, although the margin of selectivity should still be sufficiently great, provided the spraying is carried out at the correct time and recommended dosages are not exceeded.

Weeds such as charlock, thistle and buttercup will retain the spray completely even if no wetting agents are present, since they are easily wetted by water. Wetting agents would therefore not be expected to appreciably increase the toxicity of formulations to these species. There are, however, several important weeds, particularly fat hen, knotgrass, cornflower and poppy, which are unwettable; wetting agents will increase the toxicity of the hormone formulations to these species by suppressing droplet bouncing and causing an increase in the spray retention. Bengtsson has shown that greatly increased toxicity to cornflower and fat hen could be obtained by decreasing in droplet size of the spray, presumably by suppressing droplet bounce, and it seems certain that the same result could be obtained by including wetting agents in the formulation.[11]

Inclusion of wetting agents in MCPA formulations tends to make them more toxic to cereals and would not be expected to appreciably effect toxicity to easily wettable weeds. The toxicity to weeds not so easily wetted would be greatly increased, however, and since these are generally difficult to control with MCPA there seems to be quite a good case for including wetting agents in formulations intended exclusively for cereal spraying.

Other crops which are sometimes sprayed with MCPA — flax, peas and cereals undersown with clover, for instance—owe their immunity to damage in large measure to the fact that they are difficult to wet, and since the margin of selectivity is not nearly so great as with cereals, very great risk of damage would result from the addition of wetting agents to the formulation which would increase retention. However, MCPB is now replacing MCPA for use in these applications.

The risk of damage to cereals with 2,4-D is considerably greater than with MCPA,[26, 27] and since addition of wetting agents would further reduce selectivity, it seems doubtful whether 2,4-D formulations of high wetting power could be safely used on cereals. The enhanced toxicity of the 2,4-D ester formulations may be in part due

to their very great wetting power which is caused by the large amounts of emulsifying agents that the formulations, which are usually miscible oils, contain.

The phenoxybutyric herbicides MCPB and 2,4-D are more selective for certain purposes than the corresponding phenoxyacetic compounds, but since they cost more per acre to spray, their use is confined to applications where high selectivity is required.[27] Addition of wetting agents which would lower this selectivity would, therefore, be deleterious, since any advantage over MCPA would be partially lost. Holly[23] has found that the retention of MCPB on poppy seedlings is approximately one-third higher than that of MCPA. Barnsley[29] has isolated a surface-active impurity from a technical grade of MCPB which may be responsible for this higher retention. If this is so, the selectivity of MCPB could be still further improved by suitable purification to remove this impurity.

Dalapon, which is particularly effective for the control of grasses, is taken up by the leaves of the plant and translocated. Since the retention on the leaves of most grasses is rather poor, addition of a wetting agent to this herbicide will considerably increase its toxicity. TCA, on the other hand, acts through the soil, so that the wetting power of the spray is not of importance.

Pre-emergence contact herbicides such as PCP, which are non-selective, will be assisted in their action by the addition of wetting agents which increase the spray retention on unwettable plants.

### Choice of wetting agents

In choosing wetting agents for inclusion in spray formulations thought must be given to questions of stability and compatibility of the wetting agent with the other components of the formulation as well as to the biological formulation. The other compounds in the formulation may, for instance, considerably alter the solubility characteristics of the wetting agent either by acting as co-solvents or by salting out the wetting agents.

Many anionic wetting agents are partially precipitated by hard water, and although this may not affect their wetting power the form of the precipitate may be such as to block nozzles during spraying.

Most wetting agents foam to a greater or less extent. Excessive foaming may cause inconvenience during spraying, since the foam may overflow out of the spray tank. Even if this does not occur, a thick layer of stable foam in the spray tank makes refilling difficult and also makes it difficult to determine how much spray solution is left in the tank. Foaming is particularly troublesome in machines fitted with mechanical agitators.

The choice of wetting agents for use in any particular formulation should, therefore, be carried out with great care, and the writer's experience all points to the desirability of laying maximum emphasis on the fact that all tests must be carried out with the completed formulation and not with solutions of wetting agents. This is most important, since the other components of the formulation modify the properties of the wetting agents.

### Types of wetting agents

Dioctyl and dinonyl sodium sulphosuccinate are extremely powerful wetting agents, probably the most powerful currently available, if spreading power and lowering of static surface tension are taken as the criteria. They are available as 100% active materials which are waxy solids, or as concentrated solutions in either water or mixtures of alcohol and water. Both compounds are rather high foamers and are fairly stable to hard water, although the dioctyl compound is superior to the dinonyl compound in this respect and thus formulation with regard to region can be observed if so desired.

The dinonyl ester lowers the static surface tension of water even more powerfully than the dioctyl ester and also has somewhat better spreading properties, but, as was pointed out in the first of these articles, the rate at which the wetting agent is adsorbed at the freshly formed surface is of the greatest importance in spraying, and it would therefore be expected that the shorter chain dioctyl compound would be preferable for many applications. Both compounds are unstable to alkalis and would certainly not be suitable for inclusion in formulations having *p*H greater than 10. Decomposition would probably occur on prolonged storage in even less alkaline formulations. The sulphosuccinates, however, are readily soluble in organic liquids and are therefore suitable for preparing miscible oils and emulsion concentrates of high wetting power.

Non-ionic wetting agents such as polyethylene glycol esters and ethers are an extremely versatile series of wetting agents. The most generally used are probably the octyl cresol polyglycol ethers. Being non-ionic they are completely unaffected by hard water, and are indefinitely stable in acid and alkaline conditions. They are obtainable as 100% active materials which are oil soluble and can therefore be used to promote emulsification or as aqueous solutions of varying strength. They foam less than most other wetting agents.

The water solubility of non-ionic wetting agents can be adjusted to within very fine limits by altering the length of the polyethylene glycol chain. The optimum wetting power appears to be obtained when the polyglycol chain length is such that the compound is just soluble in water. For the octyl cresol polyglycol ethers this optimum occurs when the chain length is between 8 and 10 polyglycol units, although this optimum chain length may be altered by other components of the formulation which may either act as co-solvents or tend to salt out the wetting agent.

Partial esters of polyhydroxy alcohols such as glycerol mannitol laurate are useful wetting agents for sprays, although being esters they are not very stable in alkaline formulations.

The non-ionic wetting agents appear to be superior to the sulphosuccinates for high volume spraying, since they do not increase the amount of run-off and therefore reduce the amount of the spray deposit.[15] Most non-ionic wetting agents, however, are liquids or low melting point waxes and would not be very suitable for inclusion in wettable powders except at very low concentrations. There would appear, therefore, to be a need for solid non-ionic wetting agents for this purpose.

A recently developed series of non-ionic compounds, the fatty acid esters of sucrose,[30] which are fairly high melting crystalline solids, may be suitable for this application if it can be shown that, like the octyl cresol polyglycol ethers, they do not reduce the level of run-off deposits. Liquid non-ionic

compounds may be converted into free flowing crystalline solids by mixing with urea, with which they form loose complexes which are dissociated immediately on solution in water.[31] Although these complexes have not yet received the attention they merit in this regard they would probably be suitable for wettable powder formulations.

Other solid wetting agents, suitable for inclusion in wettable powders, are anionic compounds such as sodium lauryl sulphate and di-secbutyl sodium naphthalene sulphonate. These compounds have moderate wetting power and foam fairly strongly. They are, however, rather hygroscopic and may cause caking at high humidities.

Although the non-ionic wetting agents are lower foamers than most other types, they may still foam too strongly for some applications. Sulphated fatty esters such as sulphated butyl ricinoleate may be used. These esters foam fairly strongly in soft water, but the foam is unstable and subsides fairly rapidly. In hard water, however, very little foaming occurs. The sulphated fatty esters are very unstable in both acid and alkaline conditions, and are partially precipitated in hard water. Although precipitation by hard water does not seem to affect the wetting power, the precipitate might cause nozzle blocking under some conditions. This could be prevented by addition of sequestering agents such as ethylene-diaminetetraacetic acid, although cost considerations generally preclude their use.

It is clear from what has been said that no ideal wetting agent has yet been discovered, so that the formulator must strike the best possible compromise from the wide range of wetting agents that are available to him with regard to the region in which the material is to be used, its purpose or function and other economic factors involved.


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# Chemical Structure and Odour

*A paper on "Structure and Odour," presented by M. G. J. Beets of Polak and Schwarz, Holland, to the Symposium on Organoleptic Quality and Molecular Structure, in Geneva, May 2-3, 1957, has recently been published. Here is a commentary on this paper by* R. W. MONCRIEFF, B.SC., F.R.I.C., *the well-known expert on olfaction.*

THE truth of the matter is that there is no general relation between the odour and the chemical constitution of most known substances. There are many well-understood relationships between chemicals in a single class, *e.g.* those in a homologous series such as the aliphatic amines, or in the macrocyclic compounds. But when we go from class to class we are confronted time and again with questions that have so far been impossible to answer. Why, for example, should the nitro musks have the musky odour which is found in muscone and in related macrocyclic structures? Why should the ionones and the methyl heptine and octine carboxylates both have a smell of violets? Why, even in one and the same series, are the three mildly and not unpleasantly odorous alcohols, methanol, ethanol and propanol, immediately followed by the very powerful and unpleasant odorant, butanol?

## Odour differences

In a nutshell, quite closely related substances often have very different odours, and furthermore quite unrelated substances often have similar odours. This is not to say that there are not often regularities and consistencies in any one group; indeed there are. The mercaptans as a group have a characteristic type of smell; macrocyclic compounds of many kinds have a musky odour; the phenols, cresols, and xylenols have something in common odoriferously. Most selenium and tellurium compounds have objectionable odours. All sorts of similarities of this kind can be found; in a critical review of the relation between chemical constitution and odour the writer, in "The Chemical Senses,"[1] put forward 62 principles. At the time it did not seem possible to rationalise the knowledge that then existed in a small number of statements. Subsequently these principles have been accepted by other workers, *e.g.* by McCord and Witheridge,[2] who in their book reproduced some 50 of these principles. It is not possible to relate odour and structure by a simple or by a small number of relations.

Discouraged by his failure to find a simple or all-embracing relationship between chemical consitution and odour, Beets gives almost every reason but the right one to account for the failure. For example:

(1) "When one surveys all that has been published concerning the relationship between chemical structure and odour, . . . one is forced to conclude that lack of concentration, co-operation and planning has considerably retarded progress in this field."

(2) "The nose, . . . far from being a scientific instrument, is unable to record its impressions and it is entirely dependent on the quality of the brain and the eloquence of its possessor."

(3) "The serious risk that the similar (smell) impressions of two different chemical compounds may be fundamentally unrelated must be borne in mind."

(4) "Practically all the earlier work in the field and probably a large part of the more recent contributions are unreliable because of the insufficient or rather the unstated purity of the materials used."

*(Continued on page 395)*

# DISINFECTANTS and Disinfection

By A. H. Walters, F.I.M.L.T., M.R.S.H., M.I.BIOL.

*Solvents and antibacterial organic acids • Pipradol as antibacterial • Control of citrus fruit decay • Anti-seborrhœic agents Steam sterilisation of dressings • Inactivation of preservatives Phenolic effects on bacteria • Bactericides to boost virulence*

### Solvents and antibacterial organic acids

ALTHOUGH considerable study has been made on the influence of solvents on the germicidal action of disinfectants like phenols, very little analogous work has been done on organic acids.[4] The inhibitory power of the saturated aliphatic acids increases at a given *p*H as the homologous series is ascended, while that of the dibasic acids diminishes with increase in mol. wt. Sulphurous acid is exceptional as its inhibitory power appears to rest with the $HSO_3$ ion. The organic acids are used in food preservation and in medicine, and the question arose whether solvents used affected their antibacterial activity. Work was done on the action of acetone and other ketones, since previous research has shown, for instance, that 7% acetone doubled the inhibitory power of phenol.

Results of tests showed that the influence of acetone and other ketonic solvents on certain organic acids using *B. aerogenes* that the order of the bacteriostatic powers of dibasic acids in nutrient broth was maleic=malonic>malic>succinic. In the presence of 7% acetone their antibacterial power was increased. Somewhat stronger solutions of the acids were required for disinfection of infected nutrient broth than for inhibition, and, disinfection occurred at a lower *p*H. The germicidal power of the acids (15 min. test at 20° without organic matter) was increased by 20% acetone and by ethyl methyl ketone 7%, but triacetone dialcohol and ethylene glycol 30% were less effective. The dissociation of the acids at bacteriostatic and germicidal dilutions in aqueous acetone (5-20%) was not affected by the acetone present, but absorption of the acids by activated carbon was diminished. Fall in *p*H increases the antibacterial action of ketones and also formamide, but results are not clear cut and the nature of the acid appears to play a part.

In this work *Ps. fluorescens non-liquefaciens* was used for a few experiments only and no explanation given. Although the paper reads rather more like a chemical experiment than a microbiological essay the results are very interesting and open the way for more work.

### Inhibition of bacterial growth by Pipradol

*Pipradol* (α-(2-piperidyl) benzhydrol) hydrochloride is a central stimulant, water soluble and thermostable. It is used mainly for neurological studies. As a side issue its antibacterial activity against *Esch. coli* was recently tested.[1] It was shown that at levels of 500 mg. per ml. of medium it was inhibitory to the test organism grown in mineral salts-glucose medium and also to *Lactobacillus plantarum* ATCC strain 8014 grown in a more complex synthetic medium. The inhibition of *Esch. coli* was studied in detail. It was not reversed by serotonin or any of the psychopharmacological drugs investigated, and not significantly by normal growth concentrations of vitamins, amino acids and other metabolites. Competitive reversal properties were shown by yeast extract and to a lesser extent by casein hydrolysate and urine. Further tests indicated that this activity resided in a combination of amino acids. Subsequently it was found that a mixture of phenylalanine and cysteine promoted partial reversal of antibacterial activity. Following this, further information gained suggested that pipradol acts pharmacologically by competing for some enzyme system using certain precursors. It will, however, be necessary to make certain that the bacterial enzyme blocked is functionally identical with that affected by pipradol in mammalian brain tissue.

This paper indicated what may well be a new opening for antibacterial evaluation tests, namely as tracers for enzyme block function relative to living tissue metabolism.

### Control of citrus fruit decay

Citrus fruits are sensitive to attack by moulds caused by penicillium, phomopsia, alternaria and diplodia. Storage at low temperature alone is not always effective in preventing spoilage through growth of such fungi, and therefore treatment of the fruit with chemicals is also practised. Recently research into the use of 1-piperidino-2-phenyl-3-butanone hydrochloride for this purpose has been undertaken.[2] This substance, Pipone, is a white crystalline powder, mol. wt. 267·8, m.p. 166°-168°C., heat labile, and highly soluble in water and ethanol. Originally it was investigated for efficacy in the treatment of dermatophytes, since it has a high antifungal activity.

Batches of oranges were arranged in single layers in a wire basket and sprayed with various strengths of Pipone in alcoholic solution. Controls were sprayed with 8% borax. Storage was at room temperature and examinations were made weekly for visible fungus growth. After four weeks 6·6% of the oranges sprayed with 5% Pipone showed fungus growth against 13% of the controls. A further experiment was carried out under similar conditions, but after spraying the stem end of each orange was inoculated with a suspension of *Phomopsis citri*. After

four weeks at room temperature 10% of the oranges sprayed with 5% Pipone showed fungus growth against 26% in the borax sprayed group and 40% in the untreated group. Comparison with the other strengths used indicated that a 0·5% Pipone spraying gave a degree of protection similar to that of 8% aqueous borax similarly applied.

**Anti-seborrhœic agents**

The factors concerned in the onset of seborrhœa are enumerated in a recent paper,[3] together with some suggestions for the clinical and laboratory evaluation of anti-seborrhœic agents. Due to a constitutional imbalance, probably hormonal, an interference of skin function and an accumulation of epidermal scales and debris is said to result. This provides a pabulum in which micro-organisms can multiply and act pathogenically. The result is usually irritative and a scalp folliculitis may arise through scratching.

Other complications may be due to the incautious application of thioglycollates, hair dyes and lacquers, and certain shampoos. Anti-seborrhœic shampoos, rinses and lotions must be formulated with both the clinical and disinfectant angles in mind on the following lines:

1. Bactericidal activity against staphylococci.
2. Laboratory inhibition of *Pityrosporum* ovale.
3. Keratolytic action.
4. Penetration of epidermis inducing pilo-follicular cellular activity.
5. *p*H in 5·0-7·5 range.

Assays were made of 20 chemical compounds chosen as commercial or experimental antiseptics, pesticides, insecticides or fungicides. The test organisms were *Microsporum lanosum*, *P. ovale*, *S. aureus* and *S. albus*. The test technique was Cup Plate assay, and zone results measured in millimetres. Results showed the most promising agents to be the salts of the quaternary amines, the non-toxic sulphur compounds, and various chemical combinations of the halogenated phenols. It was considered that the best formulations would be synergistic combinations of antiseptics and biochemicals, viz., hormones, amino acids, vaso-dilators, enzymes, vitamins and minerals.

Although not stated by the authors, it would seem safe to assume that the disinfection tests were preliminary, since evaluations were made on inhibition zone size only. Many workers have shown the fallacy of relying on diffusion of an agent through a gel alone to give reliable disinfectant evaluation.

**Steam sterilisation of dressings**

The use of heat as a steriliser has been accepted in hospitals almost uncritically until comparatively recently, when several workers have investigated the efficiency of autoclaves. Further work now comes from Guy's Hospital,[5] in which attention is drawn to the fact that when steam under pressure is used for sterilising surgical dressings all the air must first be removed from the autoclaves, but how this shall be done is not generally agreed. Tests were made, therefore, on autoclaves with different degrees of preliminary air evacuation and the effect noted on the time taken for steam subsequently admitted to achieve required sterilising temperatures. To increase the severity of the test conditions the surgical packs used were badly sited in an overloaded autoclave. The autoclave was fitted with the necessary instruments and preliminary tests were made to ascertain the time taken to reach 115° in various positions within it, and the last point to be heated was found to be at the base just inside the door. Accordingly in all tests made later dressing drums under special observation were placed in this position. Then the autoclave was deliberately packed tight with towels, bowls, cotton wool and drums filled with dressings. Twelve envelopes containing *B. stearothermophilus* and Browne's tubes were placed in various positions in the load. Pressure was run at 15 mm. Hg (absolute) and the load exposed to steam at 20 lb. p.s.i. for 10 min. Results of some 50 tests showed that when the initial vacuum was high a temperature of 126° was reached very rapidly, but when the vacuum was lower the time required for temperature to rise from 115°-126° was half an hour or longer. From these results it seemed likely that the contents of a tightly packed autoclave would be sterilised under the conditions given provided the initial vacuum was high, as judged by the failure of *B. stearothermophilus* to survive. Therefore the authors conclude that to achieve these conditions an autoclave needs to be fitted with a pump capable of producing the necessary preliminary vacuum conditions.

Sometimes one wonders whether the breakdown risks connected with asepsis are not far greater than those associated with antisepsis.

**Inactivation of preservatives**

A useful review article has appeared on the inactivation of preservatives by non-ionic surface agents.[6] Of particular interest are sections dealing with effects of non-ionics on micro-organisms, quats and phenolics in the presence of non-ionics. Also in a short discourse on the anatomy of the bacterial cell various views on the function of the cytoplasmic membrane are touched upon. The authors note that the concentrations of phenol or polymixin taken up by bacteria to be biologically effective are similar to those which form a close packed monomolecular film surrounding an organism. They further suggest their own research indicates that this film of bactericide resides at the cytoplasmic membrane inside the wall of the bacterium. Something like 6% of hexylresorcinol uptake was isolated in the cell walls of *Esch. coli*. Reduction in binding of hexylresorcinol to the bacteria was caused by the use of cetomacrogol, and it is assumed that this substance interferes with the drug action at the cytoplasmic membrane.

**Interaction of phenolic compounds on bacteria**

Further studies have been made on the effect of phenols on bacteria.[7] Washed suspensions of *Esch. coli* treated with hexylresorcinol can result in release of presumably cell exudation substances. Spectrophotometric examinations on such cell exudate mixtures showed that at low hexylresorcinol concentrates the cell exudate released from a cell in 10 min. at 25° was proportional to the drug concentrations added. However, with increased drug concentrations this relationship was not maintained, and a limiting value was reached which corresponded to the bactericidal concentration. On the other hand, the actual amounts of hexylresorcinol taken by the bacteria

..ppeared proportional to the overall concentrations of the drug used. At bactericidal concentrations the amount of drug bound to the bacterium was greater than that needed to form a close-packed monomolecular layer around the organism. It was considered that these experimental results support the hypothesis that the site of action of phenolic compounds is at the cytoplasmic membrane.

Non-ionic surface-active agents appear to inactivate phenolics. Addition of cetomacrogol in very small amounts reduced the uptake of hexylresorcinol from *Esch. coli* suspensions. Indeed, under these experimental conditions the bactericidal and bacteriostatic activity of the drug against *Esch. coli* was completely abolished by the non-ionic agent. However, from a solution containing maximum attainable drug concentrates and a low molar ratio of cetomacrogol sufficient hexylresorcinol was taken by the bacteria to kill in the absence of the surface-active agent. It was concluded that cetomacrogol appeared to prevent or interfere with the interaction of the drug with the cytoplasmic membrane.

**Bactericides as virulence enhancing agents**

To boost the virulence of an infection *in vivo* it is often necessary to interfere with the resistance of the host. If a W-Swiss mouse is infected with a non-lethal dose of Group A streptococcus in saline suspension and, 1 hour later, this is followed by an injection intraperitoneally of broth or peptone water, then the non-lethal dose of infection suddenly appears to achieve a virulence equal to 100 lethal doses. Recent experiments bring further evidence on this phenomenon and, further, show that certain resorcinols which are bactericidal *in vitro* may be interpreted as acting as virulence enhancing agents *in vivo*.[8]

The resorcinols tested were the 4N substituted alkyl derivatives, ethyl, propyl, butyl, amyl and hexyl resorcinols. 18 hr. cultures of group A streptococci were diluted 1:10 in 0·1% solutions of the various resorcinols and kept at 24° for 30 min., thereafter W-Swiss mice were injected intraperitoneally with 0·5 ml. of the suspension: also at the same time the suspensions were tested in the test tube for surviving micro-organisms. The ethyl and propyl suspensions, as arranged for this experiment, failed to kill the organisms in the test tube, and, as expected, when these disinfectants plus surviving organisms were injected into mice they died. Under similar conditions the butyl, amyl and hexyl suspensions killed the organisms *in vitro* and when these disinfectants plus organisms which had died were injected into the mice they lived. When the disinfectants alone were injected into mice they lived. When, however, the organisms were first injected into mice and the disinfectants injected immediately afterwards there was apparently no killing effect on the organisms *in vivo*, but rather that they appeared to become far more virulent. Thus it might be deduced that such substances can be made to act as a disinfectant *in vitro* and as a virulence enhancing agent *in vivo*. Such experiments, although well planned, neatly executed, and well reported are probably most useful as indicators of the systemic effect of resorcinols when injected intraperitoneally into mice which have been previously infected by the same route.

Your reviewer cannot forbear recalling that Pasteur viewed parasitic disease as a response of the living host to an infective agent; Koch first started bacteriologists off on a search for non-toxic systemic disinfectants; Ehrlich got halfway home with arsenobenzene; and Domagk perhaps completed the picture with Fleming in hot pursuit. We seem to be going full cycle. The research now reported re-proved the old adage that what might be poisonous to infective agents might be even more poisonous to the host. Old tune—new fiddle.

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# FERTILISERS and Plant Nutrients


**By D. P. Hopkins, B.SC., F.R.I.C.**


*Fertiliser consumption • Lime • Ureaforms • Nitrophosphates Caking of granules • Sulphur • Boron*

**Fertiliser use survey**

MENTION was made in the last Report of the newly begun fertiliser practice surveys for Scotland. The importance of periodic surveys of "sample areas" has been underlined by the publication of preliminary results of a 1957 fertiliser practice survey[1] of 13 districts in England and Wales. These findings can be compared with earlier survey data for 1953 and 1954, when 11 of these districts were surveyed. Thus, trend in farm use of fertilisers —in rate of N, P or K application, in rates for this or that crop, expansions in use for grassland, etc.—can be elucidated. Whether trends revealed for a few areas typify national practice is a matter of opinion, but the districts selected for survey were carefully chosen as being representative. But nothing can disguise the fact that the total sample in this survey is a small one when set against the total acreage of national agriculture. On the other hand, to conduct a survey that gave a large enough sample to disarm all criticism would call for so much time and man-power that it would be strongly criticised for being uneconomic.

Happily, there is some cross-

**Table 1**

| | Average application per acre (crops and grass) in 1957 Cwt. per acre | | | | Change 1953/54 to 1957 Cwt. per acre | | |
|---|---|---|---|---|---|---|---|
| | | Sol. | Insol. | | | Total | |
| | N | $P_2O_5$ | $P_2O_5$ | $K_2O$ | N | $P_2O_5$ | $K_2O$ |
| Survey ... ... ... | 0·20 | 0·17 | 0·08 | 0·22 | +0·05 | −0·01 | +0·07 |
| Tonnage estimate ... ... | 0·19 | 0·17 | 0·06 | 0·19 | +0·04 | 0·00 | +0·06 |

checking evidence for the sample's accuracy. Comparison of survey results for 1953/54 and 1957 shows the rises in this period for average rates of N, P and K use. The rises in total tonnage use of these fertiliser nutrients during the same period are also known from subsidy-claim figures and other statistics. From these figures, we have an independent measure for the 1953/54-57 rises in use per acre, and this, for each major nutrient, closely agrees with the rise shown by the survey (see Table 1).

While this may not prove the absolute accuracy of the survey, its more detailed findings can, with some confidence, be considered to reflect national trends.

The survey shows that two and three times as much N and K is being used per acre in arable farming areas compared with areas where farming is mainly devoted to livestock; the ratio is four times as compared with upland livestock farming districts. Also, since 1953, increased use of N and K has been appreciably greater in the mainly arable areas. This is disturbing. It means that our annual expansion in fertiliser use, slender as it is, is largely occurring where fertilisers are already fairly generously used. Progress is much smaller where the greatest need for improvement exists. The widespread and energetic advisory drive for greater fertiliser use on grassland has so far had a poor response; it is wishfully optimistic to form any other conclusion.

Grassland in arable areas is better treated than grassland in livestock areas. Cereal acreage in arable areas is better treated than in grassland areas, though even in arable districts the percentage of cereal acres not given nitrogen or given low rates of nitrogen is still disturbing. Fertiliser treatment for root and potato crops is more consistently good irrespective of farming-type area.

## Liming

The opportunity was also taken to survey the use of lime. The percentages of 1957 crop or grass acreage given lime range, survey district by district, from 5% to about 10%—percentages above 10% are quite exceptional, and percentages around 5% are usual. This implies that a frequency of liming of about once in 20 or 15 years is a common feature of farming! It is an overall average deduction, of course, and its proper interpretation is that liming occurs with reasonable frequency only on a few farms. Yet the drive to increase liming has lasted now for 21 years—since the introduction of the Land Fertility Scheme in 1957 with its generous subsidies towards costs of lime and application.

If so much land is lime-starved and acid, can increased fertiliser rates be expected to show their full benefits. Disquieting evidence about lime use also emerges from time to time from soil sampling centres. Thus, it has recently been reported for Northern Ireland[2] that of 50,000 fields sampled and analysed in recent years 37,000 were found to need dressings in excess of 30 cwt. of ground limestone per acre. This indication of lime need—74 per cent.!—concerns not a total regional acreage but only the acreage controlled by farmers willing to seek soil analyses!

## Ureaforms

A British paper on urea-formaldehyde nitrogenous fertilisers gives new information.[3] A preliminary reaction under alkaline conditions followed by a brief acid treatment can raise the content of slowly available N. Effects upon soil *p*H are discussed; acidity increases rate of N release and this is considered a potentially important difference between these synthetic slow-N fertilisers and organic kinds such as hoof and horn meal. Attempts to prepare some methylene-ureas in pure form are described; studies of the soil decomposition of these products showed, as might be expected, that increased chain-lengths reduce rates of mineralisation. It is argued, mainly from U.S. experience, that the most likely uses of ureaform N are for lawns, turf, glasshouse beds, and potting mixtures.

Urea's use as a fertiliser *per se* has been clouded from time to time by the toxic presence of biuret. A new paper has studied biuret formation.[4] If pure urea, unstirred and melted, is heated in air at 140°C. biuret formation rises linearly with time. The presence of water as an impurity has little effect upon initial rate of biuret formation, but after 7 hr. at 140° one-third less biuret was present in urea initially containing 5% of water than in moisture-free urea. There was a reduction of about 40% in biuret formation if urea was heated in an atmosphere of ammonia instead of air.

## Nitrophosphates

Another paper has reported field comparisons of nitrophosphates with other phosphatic fertilisers.[5] The immediate effects of granulated nitrophosphates, in terms of P effectiveness, were poorer than those given by superphosphate; however, grinding the nitrophosphate granules raised their immediate efficiency. Residual effects from nitrophosphates were better, but even this improvement did not make them superior to superphosphate. It is suggested that solubility tests are poor guides to predicting the P effects of nitrophosphates as the particle size or physical properties of the granules affect diffusion rates of phosphate ions, thereby complicating deductions from solubility test results. It is possible, though this is not directly said in the paper, that the granular form, needed for nitrophosphate manufacturing reasons, is agronomically unsuitable for this type of phosphate.

## Granule caking

A TVA paper has reported[6] microscopic studies of high-analysis granular fertilisers, showing that caking is caused by the surface presence on granules of soluble salt crystals; these soluble salts form on the surfaces during storage. Salts that could cause caking were identified as potassium nitrate, ammonium chloride, monoammonium phosphate, ammonium nitrate, and a urea-ammonium complex. Drying, curing, or coating the granules with a conditioner each had

significant effects on the growth of bonding crystals during storage. The hulls of the crystals were smaller and prominent projection of crystal growth was less with granules of low moisture content. Pile curing for 7 days accelerated surface crystal growth owing to the warmth retained in the pile; subsequent breaking up of caked material caused much granule fracture, however; also, for some formulations, crystal formation still continued after the curing treatment so that caking was only partially reduced. Intergrowth of surface crystals was much reduced by kieselguhr or kaolin; crystal projection through the conditioner layer seldom occurred. Caking with conditioner-treated granules appeared due to poor distribution of the conditioner, caused either by application or by subsequent movement. It seems fair to point out that certain British work on this subject, carried out before most of the U.S. work cited in the paper's references, has not been mentioned. One regrets to note this failure to acknowledge the pioneering development of compound granulation that has been carried out in Britain.

Another TVA paper on granulation[7] has shown that certain formulations—4-16-16, 8-16-16, and 5-20-20—could be more efficiently granulated when a proportion of the solid raw materials used was of a particle size nearly equal to the desired final granule size. These larger particles act as nuclei for further granule formation, and the need for other aids, *e.g.*, water, steam, was thus reduced. Coarse triple or ordinary superphosphate was as effective in this as coarse muriate of potash. It will be recalled by readers of these Reports that British work has shown that coarse sulphate of ammonia is similarly helpful. However, for formulations that granulate well by normal methods, no advantage is gained from the use of coarser raw materials. In some cases granules were of more homogeneous character when all materials used were initially fine.

**Sulphur**

In the last Report Prof. Hugh Nicol's concepts of fertiliser ionic content and balance were discussed. A new paper[8] from this school of thought has correlated Scottish soils' *p*C values with their contents of readily soluble sulphate. It is stressed that the pronounced effect of the sulphate ion upon *p*C soil value makes this anion highly important for a soil's physico-chemical properties. About a third of the soils examined had readily-soluble sulphate contents of a low order, but further research seems necessary to establish the limits below which sulphate content is too small for normal plant growth. This paper may in one sense be regarded as a straightforward contribution on the subject of sulphur supply as an essential element for crops; but in another sense it is a paper of quite new approach, basing its nutritional argument on *p*C measurement, etc.

**Boron**

Long-term testing of borosilicate glass (or frit) as a source of boron for lucerne has been reported.[9] In the second season of cropping the boron content of the lucerne was maintained as well as in the first, indicating that the frit has a satisfactorily slow rate of boron release. It is felt that finer grinding of the glass material could raise the initial rate of boron release should more striking first-season effects be called for. This work was carried out under greenhouse cultivation conditions.

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## SILANES IN DRUGS, PESTICIDES AND COSMETICS

An entirely new chemical field, linking organic and silicone chemistry, may emerge with the introduction of chemical intermediates known as organo-functional silanes. By applying conventional organic synthesis techniques, the desirable properties of silicones can be built up into a wide variety of industrially important organic materials. As a direct result of these reactions such properties as solubility, compatibility, volatility and thermal stability can be markedly changed.

Reactions of amino-modified ethoxy-silanes with organic compounds known to possess biological activity should interest the pharmaceutical industry. The preparation of sulphonamides by reaction with sulphonyl chloride derivatives, pyrrole compounds prepared by treatment with $\gamma$ diketones, or the amine salts obtained from compounds such as penicillin, are but a few of the reactions which might be utilised in this potentially vast and important field.

The amino group of both $\delta$ aminobutylmethydiethoxysilane and $\gamma$- aminopropyltriethoxysilane provides a link for the preparation of compounds which may have pesticidal activity. Among the derivatives which have been prepared and which may have application in this field are salts of dithiocarbamic acids and the salts or amides prepared from acids of established biological activity such as pentachlorophenol and 2·4-D. Dithiocarbamates can be converted into substituted thioureas by heating. Because of the expected water resistance and insolubility upon hydrolysis of these products, such preparations promise to yield pesticides of great durability.

$\beta$-Carbethoxyethyltriethoxysilane and its hydrolysis product are novel intermediates for incorporation of silicones into cosmetic and toilet preparations. By the use of this silane it should be possible to formulate perfumes, anti-perspirants, cosmetic creams and dentifrices possessing recognisable advantages over standard formulations. Perfumes may be synthetised by the trans-esterification reaction; anti-perspirants may be formulated from the aluminium salts and cosmetic creams and pastes may be based upon the corresponding siloxane resin. Technical and commercial information relating to organo-functional silanes is available from Union Carbide Ltd.

# PLANT AND EQUIPMENT

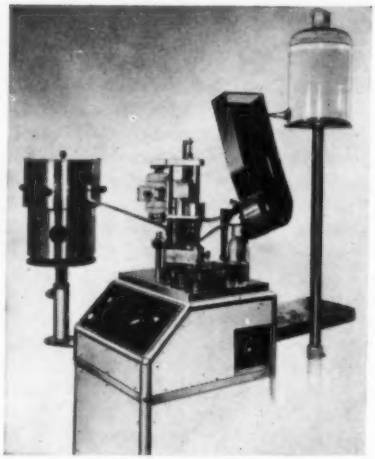
### Dental Cartridge Machine

Automatic feeding, filling and sealing of dental cartridges and similar containers is performed by the Capsolut Cartrix, a development of Schubert and Co., Copenhagen.

Its five essential features are claimed to be: air-bubble-free fillings; elimination of glass breakage; mass production of cartridges; complete automation; operation by one person only.

It has a motor for 220/380 volts A.C., 3-phase, 50 c.c., with a Kopp variator for adjustable output without intervals up to 3,600 containers per hr.

The Capsolut Cartrix costs £2,100. Schubert's representatives in the United Kingdom are the Allied International Co. Ltd., London, S.E.1.



**The Capsolut Cartrix machine for feeding, filling and sealing dental cartridges and similar containers.**

### Stainless Steel Water Baths

Gallenkamp are now using smooth finish stainless steel for their water baths. Two general purpose baths and the bath for Soxhlet extractions have already been modified, but retain their original dimensions and features. Heating is by tubular immersion elements and each bath is equipped with a safety head to protect the element should the water be allowed to evaporate. Temperature control for the Soxhlet bath is obtained by a 3-heat switch for a.c. and d.c. supplies or an energy regulator in the model for a.c. only.

The general purpose baths have six or twelve holes, $3\frac{3}{8}$ in. diam., in the top cover, each hole being fitted with a set of stainless steel rings. An energy regulator is available for use on a.c. supplies. The Soxhlet bath is suitable for six assemblies of glassware, takes flasks up to 500 ml. capacity and condensers are held by spring clips fitted to an adjustable horizontal rod carried by two vertical 24 in. long duralumin rods.

**Six-test Soxhlet extraction bath, one of the new stainless steel water baths introduced by Gallenkamp.**

### Gas Liquid Chromatography Equipment

An instrument has been developed by W. G. Pye and Co. Ltd. which is said to be capable of high resolution and extreme sensitivity. It is designed to take up to 4 metres of column, although for most analysis a single metre column of 3,000 plates is more than adequate to separate the components of the sample under test.

A katharometer is used as a detector—the overall sensitivity of the system being improved by as much as 40 times by means of the low noise d.c. amplifier connected between the katharometer bridge and the recorder. Switches are provided to change the sensitivity during a run by factors of 2, 5 and 10 over a wide range—from 100 mv. to a maximum sensitivity of 12·5 microvolts full-scale deflection on the potentiometric recorder. Under favourable conditions 1 microgram of a component in 1 millilitre of carrier gas gives full-scale deflection.

Good temperature and pressure control ensures stability at such high sensitivity. In the range 50°-250°C. the katharometer temperature is controlled to within 0·05°C. and the column within 0·5°C. The control of pressure and flow is so designed that any disturbance affects both cells of the katharometer at the same time to give maximum compensation.

This apparatus is contained in a trolley mounted cabinet

### Tablet De-dusting

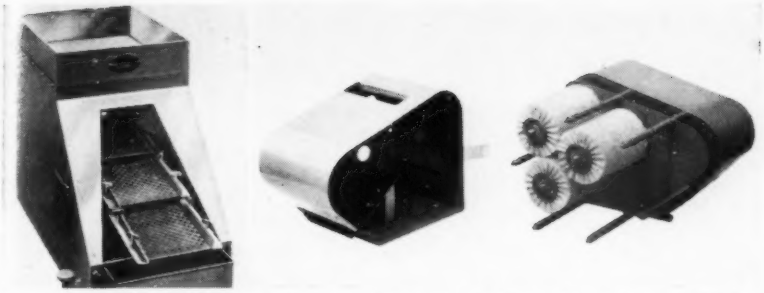
The latest de-dusting machine, Model D.1, designed by C. E. King and Sons Ltd., is claimed to handle 180,000 tablets per hr. The tablets are placed in a hopper and are fed out at a controlled rate through a rubber nozzle on to a vibrating grid. The tablets pass slowly in a single layer across three grids in all, and are dropped approximately $\frac{3}{4}$ in. (20 mm.) between each grid, turning the tablets over each time. The grids are drilled with holes in staggered positions which are approximately $\frac{1}{64}$ in. below the diameter of the tablet. Dust, chips and broken tablets fall into a removable waste bin.

Grids are made from stainless steel, anodised Dural or Perspex and are quickly interchangeable. A mechanical vibrator operates at 1,000 cycles per min. A variable speed can be fitted. The stroke is variable up to $\frac{3}{16}$ in. The angle of the machine is adjustable on hand-screws and a plastic dust-cover is provided.

The machine can be used for dusting two-piece capsules and grading sugar-coated tablets. It is stated to be particularly suitable for tablet counting machines and rotary tableting machines.

Another C. E. King machine removes the dust that clings to tablets due to electrostatic or other material characteristics. It is especially suitable for removing dust in break lines and embossing.

The tablets pass through three brushes rotating at different speeds, each side of the tablet receiving a light brushing. The whole unit is



**Left: Tablet de-dusting machine for removing broken tablets, chips and dust. Right: Tablet brushing machine for removing strongly adhering dust. Both machines are by C. E. King and Sons.**

connected to a vacuum outlet and the dust is removed completely from the machine and not allowed to build up in the brushes. Brushes are approximately 6 in. wide and 4 in. in diam., and are made from soft goat hair. They can be easily removed for cleaning, and spare sets can be obtained.

The machine has a chute inlet and is designed to mount directly under tablet making machines, tablet de-dusting machines or any other intermittent source of tablets.

### Recording Amino Acid Photometer

The Phoenix Precision Instrument Co., Philadelphia, have developed a recording flow photometer that can be used with commercial metering pumps and accessory equipment for the determination of amino acids and other amino compounds. It permits automatic recording of the concentrations of blue and yellow colours produced in the effluent from chromatographic ion exchange columns by reaction with ninhydrin reagent added to the stream. The complete photometer assembly consists of three individual photometer units, each having a monochromatic light source, optical system, and photosensitive receiver. A precision flow type absorption cell traverses all three individual photometer units to monitor the stream at wavelengths of 440 m$\mu$ and 570 m$\mu$. A special design feature enables the effective light absorption path of the third photometer unit to be shortened, thus providing a wide range of sensitivity.

The recorder supplied with the photometer prints three separate absorbance curves in multicolour dots. All switches, controls and terminals necessary for assembling and operating a complete amino acid analyser are included.

## CHEMICAL STRUCTURE AND ODOUR

(*Concluded from page* 388)

There are other controversial statements, but these will indicate the approach to the subject. But when we read: "In short, the only way to study the problem of odour seems to be to get rid of odour itself as the property under consideration in the earliest possible stage of the work," we seem to understand Beets' intuitive appreciation that really there is no general correspondence between odour and structure. In fact there is no such general relationship—the evidence against it is overwhelming—and we can leave it at that.

### Physical qualitites

Rather must we look for the prerequisites for odour to be manifest in physical qualities. Evidence has been put forward by the writer[3, 4, 5, 6] to show that the olfactory stimulus is primarily a physical act of adsorption. The root cause of discrimination between odours, and therefore of likeness of odours, has not been adequately defined. There is anatomical evidence of differences in lengths of the olfactory rod, of differences in its degree of attenuation, of differences in the number of hairs attached to the olfactory vesicle, and of differences in depth of staining by the histologist's silver stains of various parallel parts of the olfactory system. All of this, and more, has been demonstrated by Le Gros Clark[7, 8] at Oxford. Differences in the sensitivity of different mitral cells to different smells have been observed by Adrian,[9] and indications have been noted that there may be receptors which are very sensitive to a group of substances, *e.g.* sulphur compounds, and are especially sensitive to one member of the group.

The subject is still in a very diffuse state. We possess the power of fine discrimination between smells, and anatomical and physiological differences have been observed in the olfactory systems of mammals, but so far no close correlation has been possible between either a chemical or a physical property and a particular smell.

One of the promising approaches today seems to be that of Wright[10] (mentioned by Beets), who looks for "osmic frequencies" in the far infra-red spectra. This approach or one related to some other physical property seems to be the most likely to produce a useful correlation with smell at the present.

But, if Beets' paper is not able to afford the answer that he is seeking to the general problem the, mass of evidence that he has drawn together of the structures of musky compounds is impressive. His work in this respect is to be welcomed—but what it shows is that the musky smell can be found not only in many compounds, but also in many compounds that have no similarity at all of chemical structure. To the reviewer it seems to drive home the truth that there is no *general* relationship between chemical constitution and odour.

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# BOOK REVIEWS

## Ion Exchange Resins

*By R. Kunin. 2nd edn. Wiley, New York, and Chapman and Hall, London.* 1958. *Pp.* 466. *Illustrated.* 88*s. net.*

THE justification for a second edition in eight years is shown in an interesting graph published in the preface. This records that the number of papers on ion exchange resins published each year has doubled since 1950—from 600 to 1,200 p.a. Topics which were dismissed in a paragraph or two in the first edition now take up whole chapters. Examples are permselective membranes, hydrometallurgy and sugar refining.

The book has 17 chapters which take the reader from the theory and mechanism of ion exchange to the design and economics of ion exchange units. In this last chapter three typical problems are analysed costwise, namely water softening, deionisation and metal recovery. It is claimed that the book enables the reader to synthesise an ion exchange resin, evaluate the product and employ the resin for a variety of jobs. Whether such skill can be obtained by reading is debatable but certainly this new edition is comprehensive and up-to-date.

## Naphthalene Compounds

*By Norman Donaldson. Arnold, London.* 1958. *Pp.* 512. 90*s. net.*

THIS book on the chemistry and technology of naphthalene compounds is the first of its kind to appear in English. It is designed for the research chemist and the advanced student as well. The author, who works for I.C.I., has made a full search of the literature up to the end of 1954 and a partial search to October 1956.

A great deal of use has been made of information obtained from German industry by the BIOS and FIAT teams who probed the secrets of German technology in the wake of the Allied armies. Mr. Donaldson confirms one's belief in the truly unique value of this information. "I believe," he says, "that the manufacturing processes obtained from these sources give, much more accurately than most laboratory methods or patents, the precise conditions to be followed for the manufacture and isolation of technically valuable compounds in optimum yield by the cheapest routes. Such processes, which can usually be adapted to the laboratory scale, are given in this book in considerable detail, the aim being to enable the chemist to operate them without recourse to the original documents."

Among the subjects discussed are the Bucherer reaction, alkali fusion, sulphonation of naphthalene, naphthols, naphthylamines, Friedel-Crafts acylation, oxidation of naphthalene to phthalic anhydride, bond structure of naphthalenes, and azo-coupling.

## Encyclopedia of Chemical Reactions

*Compiled by C. A. Jacobson. Ed. C. A. Hampel. Vol. 7. Reinhold, New York; Chapman and Hall, London.* 1958. *Pp.* 479. 102*s. net.*

THE late Dr. C. A. Jacobson set himself the mighty task of compiling a complete list of chemical reactions involving inorganic reagents. He managed to convey his enthusiasm to over a hundred abstractors who painstakingly combed through the literature to achieve Jacobson's goal. On his death a start was made to publish the results of this immense effort. The present book is one of the volumes which have ensued. Admittedly the work is not complete, but to have rejected it because it did not fulfil an impossible ideal would have deprived us of a valuable work.

Here then are details of hundreds of reactions involving the following: strontium, sulphur, tantalum, technetium, tellurium, terbium, thallium, thorium, thulium, tin and titanium. There is a list of journals used (revealing a dearth of British publications), an index to reagents and an index to substances obtained.


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### QUICKER TABLET DISINTEGRATION

The incorporation of surfactants into tablet formulations to reduce disintegration times is discussed by Cooper and Brecht in the *Journal* of the American Pharmaceutical Association (1958, *XLVI*, (9), 520). Surfactants generally improved disintegration times when sprayed on to granulations containing starch. Ten per cent. of starch combined with 0·2% surfactant was most effective. Improvement was obtained for tablets of calcium lactate, sodium bicarbonate, tricalcium phosphate, magnesium oxide, magnesium trisilicate, acetylsalicylic acid and ammonium chloride. No improvement was obtained for tablets of sodium salicylate, A.P.C. and sulphathiazole.

Aerosol OT and Aerosol MA were most effective in reducing tablet disintegration time. Aerosol MA was slightly better.

### TREATMENT OF ACID BURNS

Treatment of hydrofluoric acid burns recommended in *Glycerin Facts* consists of immediate and abundant lavage of water for several hours followed by a wet dressing consisting of a paste made from the following ingredients:

| | % |
|---|---|
| Glycerin .. .. .. .. | 18·0 |
| Procaine HCl .. .. .. | 1·2 |
| Magnesium sulphate heptahydrate | 20·0 |
| Magnesium oxide .. .. .. | 6·0 |
| Water-soluble base .. .. | 54·8 |

**Engineer's anniversary.** A souvenir brochure celebrates the 75th anniversary of the formation of the Alfa-Laval/De Laval Group of Companies. The parent concern, the Separator Company, Stockholm, was formed in 1883 to exploit Dr. Gustav De Laval's invention of the first continually operating cream separator. From these beginnings there has developed a world-wide organisation with factories throughout Europe, North and South America and the British Commonwealth, with branch offices in many other territories.

The Alfa-Laval Group manufacture cream separators and other farm and factory dairy machinery, centrifugal separators for oil and other liquids and a wide range of engineering products including heat exchangers, stainless steel pumps, textile machinery, car body pressings, washing machines and agricultural machinery, etc. The British Alfa-Laval organisation has factories at Brentford, Middlesex and Cwmbran, Monmouthshire.

# *News . . .*

## Drug Bill Soars to £60·8 million

### Controversy over chemists' "concealed profits"

Although the number of prescriptions dispensed last year by the 15,865 chemists in the Health Service was the lowest since 1949, the national drug bill was the highest ever—£60,851,903, or 10·3% of the total cost of the Service. This was because the average prescription cost was 5s. 10·48d. against 3s. 0·04d. in 1949. These facts are given in the Ministry of Health report for 1957.

Although only 50·69% of prescriptions were for proprietary medicines, they accounted for 74·73% of the total ingredient cost. Antibiotics were the biggest item at 19·94% of the ingredient figure.

Next came hormones, two more of which were made available during the year, at 9·72%, and then barbiturates.

**"Concealed profits."** In the third report of the Committee of Public Accounts, chemists are accused of receiving concealed profits through the Drug Tariff rate. These profits are said to be made by chemists who can obtain discounts from list prices and who are reimbursed at Drug Tariff rates. When the terms of the chemists' remuneration were agreed it was assumed that no profit of this sort would accrue. An enquiry in May last year into the actual prices paid by chemists for 30 drugs, none of them proprietaries, is said to have shown that chemists in England and Wales made a concealed profit of an average of 14% on 24 of the drugs. In Scotland a concealed profit of 19% was made from 15 standard drugs and 10% from 15 proprietaries. The Treasury wants the benefits of discounts to go to the Exchequer.

A reply to the allegations has been made by Mr. H. Noble, secretary of the Central N.H.S. (Chemist Contractors) Committee. He says that the correctness of the arithmetic concerning the "concealed" profit cannot be challenged but that "the inferences which have been drawn by the Committee are very largely unjustified. In comparing the Drug Tariff price which the Ministry of Health pays and the price at which the chemists buys, no account whatever has been taken of stock losses in storage or in 'breaking bulk.' Further, whilst the 14% figure applies to the 24 drugs in question, they include the non-proprietary drugs most frequently prescribed and other evidence, secured in the same inquiry, points very clearly to the fact that, for the less frequently prescribed drugs, instead of there being a 'concealed profit' there is a 'concealed loss.'

The Public Accounts Committee states that it is disturbed that the Ministry of Health has allowed chemists to enjoy unintended profits for a period of years. The Ministry of Health and Treasury officials are, of course, well aware that the simple arithmetic of the inquiry into Drug Tariff prices does not present the whole picture. From past experience, we know that both of these Government Departments are extremely diligent in their investigations and negotiations affecting N.H.S. pharmaceutical service payments. Had the facts been as simple as the Public Accounts Committee has assumed them to be, and as the public has now been misled into thinking, nothing is more certain than that the Ministry would, before now, have adjusted their payments to chemists. No such general adjustment is, however, justified or justifiable on the evidence available. Indeed, the further evidence currently being collected on the costs of providing the N.H.S. dispensing service will, we believe, show that chemists are being underpaid."

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### Chemical output doubles

While output in the British chemical industry has doubled in the past 10 years its labour force has increased by only 20%. Mr. M. Viviani, work study and productivity officer of the Association of British Chemical Manufacturers, told the Association's Scottish area members this recently when he spoke of "Measurement and Productivity."

During that period, he said, output per unit of labour had increased by about 65%, the highest level achieved in any British industry. Some £370 million had been invested in the chemical industry since the 1948 investment figure of around £230 million.

There was still no completely satisfactory method of measuring productivity, and indeed it might be that there was no major need for maximum accuracy. The purpose of productivity measurement indices was primarily to compare the efficiency of an organisation with others or to relate progress to achievements in the past. It was a worthwhile exercise and could assist management in measuring progress. If Britain were to catch up with the American standard of living, the necessity existed to increase productivity, measured as out-put per unit of labour, by about 10% per annum. In practice the figure was at best about 3½%, although the chemical industry was undoubtedly showing the way with an annual increase of about 8%.

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### New subscription rates for "Manufacturing Chemist"

For many years, certainly since before the war, the announcement of new prices for this or that commodity has been a euphemistic way of asking the buyer to pay more. It is with special pleasure, therefore, that we are able to announce a reduction in the subscription rates for MANUFACTURING CHEMIST. The rate of **£2 per annum post free** instead of £3 will apply immediately to all new subscriptions and to renewals. The 3-year rate offers still more favourable terms—£5 instead of £7 10s.

This reduction has been made possible because of the steadily increasing circulation of MANUFACTURING CHEMIST and is in accordance with our objective of promoting the widest possible dissemination of the valuable technical information the journal contains.

We know that in some cases as many as six people share one copy of the journal. It is hoped that the new rates (only 3s. 4d. per issue post free) will encourage these people to take out a subscription for their personal copy.

The new policy of lower subscription terms has been applied throughout the Leonard Hill Technical Group.

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### I.C.I.—Ilford link-up

Ilford Limited and Imperial Chemical Industries Ltd. are to co-operate in the technical and commerical development of colour photography. Ilford will pay royalties for the technical assets developed by I.C.I. for colour photography, and I.C.I. will do research for Ilford. The manufacture and sale of colour photographic products will be undertaken by Ilford.

Ilford will require substantial additional finance which I.C.I. will provide by buying over a period of five years 6,400,000 new Ilford Ordinary shares of 5s. each at 15s. per share. I.C.I. will thus acquire approximately a one-third interest in the Ordinary capital of Ilford.

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### Boots' interim dividend

Boots Pure Drug Co. Ltd. announce that the interim dividend for the half year ending September 30, 1958, will be maintained at 3% less tax on the increased Ordinary share capital.

### Polio vaccine duty exempted

The Treasury have made the Import Duties (Exemptions) (No. 15) Order, 1958, which continues until the end of 1958 the exemption from duty of poliomyelitis vaccine, Salk type.

### Chemicals freed from import controls

Import licences are now not required for a wide range of chemicals and allied products imported from the dollar area. This means that with certain exemptions such as dyestuffs and intermediates, import-licensing has been lifted from most chemicals used as industrial materials.

The Open General Import Licence (No. 2), giving effect to this decision, and specifying the chemicals concerned, is obtainable from the Stationery Office.

### Lister Institute products

Allen and Hanburys Ltd. have relinquished the distribution of Lister Institute vaccine lymph, sera, antitoxins and bacterial vaccines. Macarthys (Wholesale Chemists) Ltd., Macrom House, Seymer Road, Romford, have taken over the distribution.

### Gallenkamp's new agency

A. Gallenkamp and Co. Ltd. have been appointed sole agents for the United Kingdom, for the continuous recording process instruments manufactured by Beckman Instruments Inc. These include their electrolytic hygrometer, *p*H meters, gas chromatographs, leak detectors, oxygen analysers and flow colorimeter.

This is in addition to the agency held for spectrophotometers, electrophoresis apparatus, $CO_2$ analysers, gas chromatographs and other laboratory instruments.

### Milling machinery centenary

The centenary of Christy and Norris Ltd., engineers, of Chelmsford, was celebrated by a luncheon party attended by 120 people. Guests included the Mayor and Mayoress of Chelmsford.

Fell Christy set up business in 1858 to fabricate and service grain mills. In 1872 the firm started to manufacture a beater type of disintegrator, a revolutionary step in milling and grinding standards. As a result of this development the founder called in James Alfred Norris to help mainly with commercial aspects of the business.

On Fell Christy's death at the end of the first World War the private company of Christy and Norris Ltd. was formed. In 1942 they designed the Essex mill which was re-designed as the Essex major mill six years later. In 1948 the firm merged with another family branch—Christy Bros. Ltd.

## Technical Press Review—September

**Food Manufacture.** — The Morecambe Bay Potted Shrimp Industry; Ultrasonics in Food Manufacture; Glass Packed Foods and Beverages; Improving Nutritive Value—with special reference to the enrichment of foods—III; Autoxidised and Heated Fats as a Nutritional Hazard.

**Petroleum.** — Belayim Crude — the advantage of coking—II; Applications of the Unisol Process in Great Britain; Arrangement of Compressors for Mineral Oil Deposits; Fresh Air; Mud Pumps Research; Long Distance Gas Pipeline; New Metals in the Oil Industry; Operational Control Equipment.

**Atomics.**—The Significance of Geneva; Nuclear Energy in the Service of Mankind; How Radiation Damages Metals; Isotopes Measure Engine Wear; The Selection of Reactor Coolants; The Commercial Exhibition at Geneva; Governments Show their Wares to the World.

**Paint Manufacture.** — Conference on High Polymers, Nottingham; Aluminium; versatile pigment; Fading of Printing Inks — 2; Epoxide Resins.

**Dairy Engineering.** — Dairy Wastes; Purity of Water for Use in Dairies; The Measurement of the Colour of Sterilised Milk; Repair and Renovation of Fractional Horse Power Motors; Preventing Corrosion in the Dairy Industry.

**Chemical and Process Engineering.**—Materials Handling in the Chemical and Allied Industries; Steam Traps; The Changing Pattern of Gas Manufacture; Uranium from Lignites.

**Corrosion Technology.** — Anodising Bath for Magnesium Alloys; Shotblasting in the Shipyard; High Pressure Phenolic Laminates in Chemical Plant; Protecting Steelwork with Epoxide Enamel.

**World Crops.**—A Complete Fertiliser; Potash Manuring; Organic Irrigation; A Trace of Copper.

### Change of address

The head office of the Institution of Incorporated Plant Engineers has been moved to 2 Grosvenor Gardens, London, S.W.1, telephone Sloane 0469.

### K.I.D. exemptions

The Treasury have made an Order continuing until December 31, 1958, the exemption from Key Industry Duty of all articles exempted from that duty by previous Orders which expired on August 18, 1958, with the following additions and deletions of chemicals:

**Additions**

Ammonium thiocyanate
Calcium dichromate
Carboxymethylcellulose, aluminium salt
*o-mono*Chlorobenzaldehyde
Dimethylamine
Dimethyl *p*-nitrophenyl thionophosphate
Diphenyl ether with a crystallising point not lower than 26·5°C
17-Hydroxycorticosterone labelled with radioactive carbon of atomic weight 14
L-Lysine dihydrochloride
Magnesium carbonate in the form of 2 oz. blocks measuring approximately 4 in. by 2¼ in. by 2 in.
Methyl n-hexyl ketone of a purity not less than 85%
1-Nitropropane
2-Nitropropane
*n*-Octoic acid
Zinc diamyldithiocarbamate

**Deletions**

Cerium oxide, pure
*mono*Acetylacetone
*a*-Aminodiphenylmethane hydrochloride (aminodiphenylmethane salt)
Barium manganate
Benzylcellulose
Bismuth oxychloride, crude
Butacaine sulphate
*n*-Butyl alcohol
*mono-tert*Butyl-4-hydroxyanisole
Calcium 2-iodoxybenzoate
(-)Carvone
*w-mono*Chloroacetophenone
3-Chloroaniline
*N* - *p* - Chlorobenzyl - *N'N'*- dimethyl - N 2 pyridylethylene diamine hydrochloride
2 - *p* - Chlorophenoxyethanol
2 : 6 Diamino-3-phenylazopyridinium chloride
2 : 6 - *Ditert*butyl-p-cresol (—OH=1)
*Ditert*butyl diperphthalate
Dicyandiamidine phosphate
Dimethyl *iso*amylethylmalonate
2 : 6 - Dimethylheptan - 4 - ol
3 : 7 - Dimethyl - *n* - octaldehyde
*p* - (Di - *n* - propylsulphamyl)benzoic acid
Ethyl abietate
Ethyl 2-benzoylbenzoate
Ethyl 4 : 4' - dihydroxydicoumarinyl - 3 : 3' acetate
Ethyl$^{\beta}$ - 3 : 4 - dihydroxyphenylpropionate
Ethyl 13 : 14 - di - iodobehenate
Ethylene brassylate
Ethyl$^{\alpha}$ - hydroxy - *a* - methyl - *n* - butyrate
Ethyl lactate
Ethyl linoleate
N - Ethyl - 3 - piperidyl benzilate methobromide
*N* - Ethyl - 3 - piperidyl diphenylacetate hydrochloride
5-Ethyl-2-sulphanilamido-1:3:4-thiadiazole
4-Hydroxy-2-aminopyrimidine
Menthyl *mono*ethoxyacetate
3-Mercaptopropane-1 : 2-diol
3 : 2 - Mercurioxy - 4 - nitrotoluene
4-Methylpentan-2-ol
*B*-Picoline
Piperonylic acid
3-Pyridylmercury acetate
Safrole
Sodium sulphite
R Sodium 2 : 4 : 5-trichlorophenoxide
Sodium xanthate
Strontium 2-ethylhexoate
Tetraisopropyl orthotitanate
R Titanium dioxide
Toluene-*p*-sulphondichloroamide
Tolylene-2 : 5-diamine sulphate
3 : 3 : 5-Trimethylcyclohexyl mandelate
10-Undecenaldehyde
*p*-Xenylamine
R *DL*-Xylose

# People

Thomas Morson and Son Ltd., have appointed **Mr. E. S. Hopkins** as home sales manager.

**Mr. B. V. Jones,** M.R.C.V.S., has been appointed head of the veterinary research department of Allen and Hanburys Ltd.

**Mr. George West,** who has been appointed export manager of the Chemicals Division of Newton Chambers and Co. Ltd., is the son of Sir Harold West, former managing director of the company. He succeeds **Mr. C. R. Lund,** who died in June.

Huffer and Smith Ltd. (Fine Chemical Division of C. F. Gerhardt Ltd.) have appointed **Dr. Jason T. W. Mann,** F.R.I.C., D.I.C., A.R.C.S., B.SC., as head of research and development. In this appointment he becomes senior technical executive of Huffer and Smith Ltd., and of the parent company, C. F. Gerhardt Ltd. He was fomerly in charge of research and development of Whiffen and Sons Ltd., Fulham factory.

The Minister of Health has appointed **Dr. D. Thomson,** M.D., D.P.H., principal medical officer, to be a deputy chief medical officer from October 1, 1958, on the retirement from the public service of **Dr. G. A. Clark.** Dr. Thomson was a member of the special mission to Malta in connection with the tuberculosis services there and has attended the meetings of the Medical Committee of N.A.T.O. in Paris.

The Board of Trade announce that the **Earl of Halsbury** will retire from the position of managing director of the National Research Development Corporation on March 31, 1959, to take up another appointment. Lord Halsbury was appointed temporary adviser to the Board of Trade in May, 1949, in anticipation of the establishment of the Corporation and his appointment as its first managing director was made at the end of June, 1949. He was therefore responsible for the launching of the Corporation and will by next March have directed its activities for nearly 10 years.

One of the first of the new life peers is **Mr. V. F. Noel-Paton,** chairman of T. and H. Smith Ltd., Edinburgh. He joined the board in 1951, becoming chairman of it during the same year. He became chairman also of Duncan, Flockhart and Co. Ltd. when that company became a member of the Smith group of companies in 1952, and continued as chairman until 1955. He was born in 1900 in Edinburgh and spent 31 years in India from 1920. He is a Director of the Edinburgh Chamber of Commerce and a Member of the Executive Committee of the Lanark constituency Unionist Association. He has recently taken a prominent part in the affairs of the Church of Scotland.

**Mr. E. B. Wastell,** general manager of the Selby, Yorks., works of John and E. Sturge Ltd., has retired at the age of 65. He joined the firm in 1911 to work in the laboratories at Lifford, and later became works manager of the Wheeleys Lane, Birmingham, works, a position he held until the beginning of the last war. He was largely responsible for setting up the citric acid plant at Selby during 1939-40, and under his guidance the production of citric acid has been increased to five times the original output.

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## Obituary

The death has occurred at the age of 86 of **Mr. Henry Ellison,** former chairman of Yorkshire Tar Distillers Ltd and the Sheffield Chemical Co. Ltd. He was a benefactor to Sheffield University and also made a gift to Leeds University.

**Mr. Tito Giusti,** who founded the chemical engineering firm of T. Giusti and Sons Ltd. in 1918, died on July 23 aged 86. He was originally a naval architect.

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## Allenburys to build factory for Iranians

A £1 million pharmaceutical factory covering 180,000 sq. ft. is to be built for the Iranian government by Allen and Hanburys Ltd. It will be built 15 kilometres outside Teheran and it is expected to be ready in about 12 months.

Allenburys won the contract in the face of competitive offers by German and U.S. firms from the Imperial Welfare Organisation (Darou Pakhsh) which provides free medicine for the under-privileged and is under the direct guidance of the Shah. Allenburys already export to Iran. Now they will substantially increase exports to fill the gap until the new factory starts production. The products to be made are injection solutions, tablets, intravenous solutions, ointments, etc.

The Iranians have put up all the capital. Allenburys will design the factory, staff it with their own experts from England and maintain full technical control. In the meantime they will train Iranians for the factory in their own plants in England.

The agreement is for a minimum period of 15 years and may then be extended for another ten. Allenburys will be paid royalties on the total production of the factory. The contract was signed in London on August 27.

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## Herb crop report from Stafford Allen

Herb crops on the farms of Stafford Allen and Sons Ltd. at Long Melford, Suffolk, have grown rapidly but development generally has been retarded due to the lack of sunshine. The weather conditions early this year made it difficult to cultivate the land and the late frost in May gave the crops a severe check. This was offset by the spring and early summer months being among the wettest for many years, which resulted in the rapid growth of green crops. The development of the active constituents may have received a setback due to the lack of sunshine.

*Belladonna herb.* The first cut was excellent and with favourable weather conditions it is expected that a second cut will be made.

*Chamomile.* Severe frost in the spring made it very late before plantings could be made, but the wet weather has suited this crop. It looks in good condition and the oil yield is coming well up to expectations.

*Clary sage.* A bumper crop has given a good yield of oil.

*Digitalis.* Heavy rains have resulted in good growth, but they may make it difficult to cut and to dry. It is hoped, however, that the final crop will be of a high standard.

*Dill.* Given some sunny weather this should have a good yield of seed containing much oil.

*Hyoscyamus.* The second year herb was good and the first year crop has improved since earlier on.

*Lavender.* Further plantations have been set out, and although in general the flowers were not uniform this season, nevertheless, a moderate yield of oil was obtained.

*Parsley.* The acreage of parsley which was left for seed has made good growth, but here again more sunshine is needed to ripen the seeds before they are harvested for oil.

*Peppermint.* This year the beds have been extended on to ploughed-up meadow land which had been under grass for a number of years. As a result the plants have made excellent progress, producing a bumper crop and some good English peppermint oil.

*Poppy petals.* Each year it becomes increasingly difficult to find fields in which these have been allowed to grow, due mainly to the fact that many farmers spray their fields and crops with weedkiller. Nevertheless, the usual collection has been made.

# Beecham spend £2m. on new factories in 5 years

The Beecham Group is to construct a factory for one of its companies, County Laboratories Ltd., at Maidenhead, Berkshire. During the past five years the group has spent more than £2 million on new buildings and extensions to existing ones. They include the Lucozade factory and laboratories for Beecham Foods Ltd., and Beecham Maclean Ltd., Brentford, Middlesex, a factory and depot for Beecham Foods Ltd., Manchester and at Newcastle-on-Tyne, and extensions to the factory of Beecham Pharmaceuticals Ltd., St. Helens, Lancashire.

Overseas new projects have included those of Harold F. Ritchie Inc., Clifton, New Jersey; Eno-Scott and Brown (Brazil) Ltd., Rio de Janeiro; Eno-Scott and Brown (Venezuela) Ltd., Caracas; Harold F. Ritchie and Co. Ltd., Toronto; Group Laboratories (Australia) Pty. Ltd., Melbourne; Proprietaries (Sales) Ltd. and Proprietaries (Eire) Ltd., Dublin; Beecham Foods Ltd., Belfast; Beecham (Nederland) N.V., Amsterdam; and Group Laboratories (India) Private Ltd., Bombay. A factory is being planned for Eno-Scott de Mexico S.A., in Mexico City.

Group trading profits for the year ended March 31, 1958, after charging depreciation of £846,588, and after providing for staff participation in profit, amounted to £6,093,396 (£4,516,123). Total sales rose by more than £5 million to £34,152,816.

**Home trade.** Sales have nearly doubled since 1954 and stood at nearly £23 m. last year. Proprietary foods and beverages sales reached £11,507,365 (£8,755,034 in previous year). *Lucozade* is the company's principal beverage and sales have risen substantially. Proprietary medicines sales reached £5,561,097 (£4,623,048), Beecham's Powders and Phensic being particularly successful. Among the new and promising ethicals *Nacton* for the treatment of gastric conditions.

Sales of toilet products increased to £5,855,522 (£5,116,455). The group's shampoos last year accounted for nearly one-third of the total purchases of shampoos in the U.K. A newcomer is *Water Lilies* shampoo in leaf form. Demand for Macleans tooth paste also increased.

**Overseas trade.** *Brylcreem* made a substantial contribution to the group's profit in the United States after some years of losses. Now it sells more in the U.S. than in Britain—where it holds 40% of the hairdressings market. It is also becoming increasingly popular in Canada and Italy. Recent introductions which the group have made to the Canadian market are Silvikrin shampoos and Macleans tooth paste.

## B.P. and B.P.C. amendments

**Ipecacuanha.** The Pharmaceutical Society has published an amendment reducing the quantity of tincture of ipecacuanha in the following preparations to one-half the volumes stated in the monographs. The amendment took effect on September 1, 1958.

Mixture of ammonia and ipecacuanha.
Mixture of Belladonna and ipecacuanha for infants.
Alkaline mixture of ipecacuanha.
Mixture of ipecacuanha and morphine.
Mixture of ipecacuanha for infants.

The reduction is occasioned by the increase in alkloidal content of ipecacuanha tincture in the British Pharmacopœia 1958.

**Strong ammonia.** The Society has also authorised the publication of a statement that B.P.C. preparations made with strong ammonia solution shall continue to comply with the current standards. The content of $NH_3$ in strong solution of ammonia B.P. 1953 is 32·5% w/w (limits 31·5 to 33·5), but in strong ammonia solution of the B.P. 1958, which came into force on September 1, 1958, it is 27·0 to 30·0% w/w. Three preparations are affected: aromatic spirit of ammonia and ammoniated liniment of camphor (both included in the B.P.C. on September 1 by announcement published in April 1958) and aromatic solution of ammonia. When making these preparations with strong ammonia solution B.P. 1958 the amount used should be increased appropriately. The strength of the alcohol used to prepare ammoniated liniment of camphor should also be increased so that the liniment will comply with the standard for alcohol content.

## I.C.I. workers' bonus

Over 90,000 employees of Imperial Chemical Industries Ltd. have qualified for bonus in respect of 1957 under the company's profit-sharing scheme. This bonus amounts to £4,993,000 gross (average per employee £54 17s. 6d.), which after deduction of personal income tax is £3,716,000 (average per employee £40 16s. 9d.).

## Pharmacology course

A course of six lectures on the pharmacology of drugs acting on the central nervous system will be held at the School of Pharmacy, Brighton Technical College, on Tuesday evenings from September 30 to November 4. The fee is £1 and application forms may be obtained from Dr. J. C. Parkinson, School of Pharmacy, Technical College, Brighton 7.

## Factory extension

Cromessol Co. Ltd., manufacturing chemists, are planning to extend and improve their factory at Brand Street, Glasgow, S.W.1.

## Carbonisation plant postponed

Staveley Iron and Chemical Co. Ltd., who proposed building a new carbonisation plant at Sheepbridge, Chesterfield, have deferred the plan for the time being. It is understood that there is no urgency for this project at the moment.

## Highly dispersed titanium oxide

In addition to the highly dispersed oxide of silica, *Aerosil*, Degussa of Frankfurt (Main) are now regularly producing highly dispersed oxides of titanium, aluminium, and iron which are made by the pyrogenic phase. Samples and data are available from the sole concessionaires, Bush, Beach and Gent Ltd., London, E.C.3.

## Courses at Cass College

Degree courses in chemistry will commence this month at the Sir John Cass College, Jewry Street, London, E.C.3.

## Weed control conference

All aspects of weed control will be dealt with at the 4th British Weed Control Conference which is to be held at the Hotel Metropole, Brighton, from November 3 to 6. Registration forms can be obtained from the S.C.I. 14 Belgrave Square, London, S.W.1.

## U.S. firm's project

The Food Machinery and Chemical Corporation of New York has appointed the Cocker Chemical Co. Ltd. of Lancs., exclusive distributors for cyanuric acid, chlorinated cyanuric acids and derivatives. FMC plan to have these products available in commercial quantities for export to the U.K. as from early in 1959. This distributorship agreement is entered into with a view to the setting-up in due course of manufacturing facilities in the U.K., which would be operated as a joint venture by the two companies.

## QVF—Pyrex merger

James A. Jobling and Co. Ltd., of Sunderland, manufacturers of *Pyrex* glass, have purchased from Triplex Holdings Ltd. the entire share capital of the Quickfit group of companies, comprising Quickfit and Quartz Ltd., manufacturers of interchangeable laboratory glassware, of Stone (Staffs.); Q.V.F. Ltd. industrial engineers in glass, of Fenton, Stoke-on-Trent; and Q.V.F. Glastechnik G.m.b.H., of Wiesbaden, Germany.

A notable increase in exports of British chemical glassware is expected to be one of the first results of the merger.

### New pharmacists

Three hundred and seventy-five candidates, 123 women and 252 men, qualified as pharmacists at the examinations held last month in England and Scotland.

### Company acquired

Thawpit Ltd. has acquired Coliclean Ltd. and will manufacture *Coliclean* at a new factory in High Wycombe. The product is now packed in a new tube designed to prolong shelf life.

Correspondence should go to Thawpit Ltd., Woodstock Grove, London, W.12.

### Fuel costs cut

W. R. Smith and Co. Ltd., gelatin and glue manufacturers of Tattenhall, near Chester, had a heat and power survey carried out last November by the National Industrial Fuel Efficiency Service. At that time normal coal consumption for process was 75 tons per week. As a result of N.I.F.E.S.' services the annual fuel and power bill has been reduced by 30% and requirements to 46 tons per week.

### Stains and reagents exhibited

Edward Gurr Ltd. exhibited a range of their Michrome stains and reagents, histochemical reagents and books by the company's managing director, Mr. Edward Gurr, at the XVth International Congress of Zoology (Darwin-Wallace Centenary) held at South Kensington. They were the only exhibitors specialising in the production of biological stains and reagents.

Nearly 2,000 biologists attended the Congress, the president of which was Sir Gavin de Beer, F.R.S.

Among Mr. Gurr's books on display was "Methods of Analytical Histology and Histochemistry" just published by Leonard Hill (Books) Ltd., 9 Eden Street, London, N.W.1.

### Evans concentrate on tubing and bottling

Replanning at the Elstree factory of Evans Chemicals Ltd. has improved production efficiency.

For many years the company have been prepared to handle any filling job and the factory was laid out to secure maximum planning mobility and flexibility. It has now been decided to specialise in the filling of metal and polythene collapsible tubes and glass or polythene bottles. Space is being reserved for "special" jobs, but the emphasis will be on tubes and bottles.

This decision to concentrate on tubing and bottling has made possible certain changes in factory organisation which allow for an improved output by operatives.

# *News from Abroad*

## GHANA

### Insecticides and soap

Imperial Chemical Industries (Exports) Ltd., are to erect a factory at Tema to manufacture insecticides for sale to the Ministry of Agriculture.

The United Africa Co. of Ghana Ltd. are planning to build a £1 million soap factory at Tema which should be in production in two to three years' time.

## INDIA

### Cottonseed conference

A symposium on cottonseed and its by-products will be held at the Regional Research Laboratory, Hyderabad, on December 5-7, 1958. Discussions will cover processing and storage; agricultural studies; refining; hydrogenation; solvent extraction; fundamental studies; standards, statistics and marketing data.

Enquiries should be sent to the Director, Regional Research Laboratory, Hyderabad (9), Deccan.

## ISRAEL

### New drug factory

In the new development centre of the Negev town of Ashdod on the Mediterranean coast, the cornerstone has been laid for a I£2·5m. pharmaceutical factory which, according to official estimates, will be able to export to 20 countries. Private American capital is being used to finance the factory and it is hoped that this example will now attract other private investments.

## AUSTRALIA

### Drug industry's growth

The Australian pharmaceutical industry is strongly established, reports the Department of Trade, and is steadily expanding. The demand for its products over recent years has increased at a rate greater than that of population growth. Prospects for the remainder of this year indicate an overall rise in output of at least 5%. Imports of pharmaceuticals in 1956-57 were valued at £5,600,000; about 60% came from the United Kingdom.

## JAPAN

### Petrochemicals and plastics

The Mitsui Petrochemical Co. and the Sumitomo Chemical Co. are to put domestically-produced polyethylene on the market for the first time. Mitsui is said to have a production capacity in its Iwakuni factory of 12,000 tons each annually of polyethylene, toluol and xylol, 6,000 tons of ethylene oxide and 4,800 tons of ethylene glycol. Only the last two items will be put into full production at once, the others being produced at half-capacity rate for the present. The Sumitomo factory at Niihama is said to have an annual capacity of 11,000 tons of polyethylene.

## AUSTRIA

### Petrochemicals to be made

The Supervisory Board of the IBV (Industrie - und Bergbauverwaltung which exercises control at the top level over a number of nationalised industries) have approved the setting up of a petrochemical concern composed of the Austrian Stickstoffwerke (nitrogen, fertilisers, chemicals) and the Italian Montecatini Co. and private groups. The two companies will each hold 40% of the shares and 20% will be subscribed by private groups.

This new company will greatly strengthen the Austrian chemical industry, which last year produced goods worth 7·7 billion schillinge, or about 13% more than in 1956. The value of medicinal and pharmaceutical preparations produced in 1957 was 368·5 million schillinge, or 7% above 1956, of which about 13·2% was exported.

Exports by Austia's chemical industry rose from 1,600 million schillinge in 1956 to 1,900 million schillinge in 1957 (20·3%).

## CHINA

### British chemicals bought

Among the three main items imported from Britain during the first half of 1958 were chemicals valued at £1,171, 773. During this period British exports to China reached £12,697,777, more than 60% higher than in the same period last year.

### Expanding chemical industry

Harbin is to become one of China's main chemical bases. Thirty-one chemical plants will go into construction this year and by 1962 there will be 65 large and medium scale chemical plants. They will include a synthetic fibre plant with an annual output of 6,000 tons of caprone, a synthetic rubber plant with an annual output of 2 million tons, a fertiliser plant with an annual output of 2,000 tons of plastic. In addition there will be two gas plants, producing sulphuric acid, caustic soda and calcium.

A fertiliser plant with an annual capacity of 800,000 tons of ammonium sulphate is being constructed in Hofei, Anhwei Province. All processes will be automatic and the first stage will be completed in 1960. A bacterial

fertiliser plant has started production in Peking.

Dyestuffs works in Tientsin and Shanghai have announced the successful production of dyes with an active radical. Tientsin has manufactured 35 kinds and Shanghai 33 kinds. The dyes are said to be good for cotton, silk linen, wool and synthetic fibres. In fastness to light they are grade 6 and to washing, perspiration and rubbing grade 5.

An ammonia converter used in making synthetic ammonia with a pressure of 1,500 atmospheres has been manufactured in Dairen. China's first up-to-date cellophane paper mill will go into operation in Tientsin this year with an annual capacity of 1,400 tons.

### New drug plant

China's biggest and most modern pharmaceuticals plant which began construction in 1955 is in full operation in Tientsin. It is called the North China Pharmaceuticals Plant and has departments of antibiotics, starch and glass making. Designing and construction of the plant and the training of technicians was undertaken by Russia and East Germany. With the completion of the plant China is now said to be basically self-sufficient and will be able to export some pharmaceuticals. Construction has begun of a factory in Huhehot, Inner Mongolia, for the production of veterinary vaccines and sera and it is expected to be completed by the end of 1959. It will make anti-anthrax serum, attenuated virus for sheeppox, vaccine for contagious pleuropneumonia of cattle and vaccine for chickens, goats and other livestock. China's biggest ephedrine factory, in Inner Mongolia, is producing at the rate of 4 tons per month.

### Essential oils

It is claimed that distillation capacity for citronella oil production in Hainan island is now sufficient to enable the island to export quantities equal to one-half of current world supplies. Other essential oils produced on the island include lemongrass oil, patchouli oil, eucalyptus oil and spearmint oil.

## SOUTH AFRICA

### Allenburys New laboratories

New laboratories of the Research and Control Department of Allen and Hanburys (Africa) Ltd., at Congella, Durban, are now in operation. Refurnishing and refitting the laboratory was commenced last year. The present department consists of two laboratories, a records office, a dark room, sample storage room and a library. Laboratories and office are air-conditioned, light and airy.

One of the laboratories is devoted to general analytical and control work and to experimental work on the formulation and stability of new products. Ample and well-designed space has been provided for six workers in this laboratory. Steam and compressed air are supplied and propane-butane is available at each bench as a gas supply. Almost all the apparatus is new and includes balances of varying sensitivity for various requirements; thermostatically controlled incubators for storage tests on new products and new packaging materials; apparatus for determination of *p*H, conductivity, viscosity, refractive index and light absorption. A new polarimeter of high precision will soon be installed in the dark room.

Part of the new laboratories of the Research and Control Dept. of Allen and Hanburys (Africa) Ltd., at Congella, Durban.

The second laboratory is restricted to microbiological work and will provide equipment and facilities for microbiological assay of antibiotics and vitamins, evaluation of antibacterial and antifungal activity of new substances and preparations, and experimental and development work on the preparation of sterile products together with the testing of such products for sterility.

The library is housed in a separate room.

The new laboratories should be easily adaptable to future changing methods and to an enlarged scope of work.

The job of setting up the department was undertaken by Mr. C. J. Eastland, F.P.S., F.R.I.C., who went to Durban from the parent company's laboratories in England, for six months at the end of 1956 and again in October last year. Mr. Eastland was formerly head of the firm's pharmaceutical research department and is a member of the Action and Uses Sub-committee of the British Pharmaceutical Codex Revision Committee and of the Galenicals and Ointments Sub-committee of the British Pharmacopœial Commission. He has been an examiner for the Pharmaceutical Society of Great Britain since 1949.

Newly appointed head of the Research and control division is Dr. B. A. Wills, B.PHARM., PH.D. Senior chemist in the department is Miss Jennifer Heathcote, B.PHARM.(LOND.), M.P.S.

## UNITED STATES

### Antibiotic firms accused

Anti-trust charges have been made against six of the leading antibiotic manufacturers by the Federal Trade Commission which last month issued an economic report on the antibiotics industry. The firms are accused of attempts to monopolise the industry and to fix artificial and non-competitive prices. *Chemical and Engineering News* reports also that one of the six, Pfizer, is accused of making misleading statements to get the key patent (US 2699054) on tetracycline.

The firms which have drawn the fire of the Commission are Upjohn, Olin Mathieson, Bristol-Myers, Bristol Laboratories, Pfizer and American Cyanamid. All emphatically refute the charges with protests ranging from "shocking" to "baseless." Pfizer say the Commission's charges on the tetracycline patent could wreck the U.S. patent system.

In the U.S. the broad-spectrum anti-

biotics have captured 39% of the total antibiotics market which, in 1956, was worth over 333·3 million dollars. The Commission says that since 1951 there has been no change in their prices (about $5·10 for sixteen 250-mg. capsules). Furthermore antibiotics manufacture is being slowly concentrated in the hands of a few firms. In 1956 there were seven penicillin producers compared with 14 in 1949. Half the total antibiotics production in 1956 came from two companies and four made 82% of the penicillin. Of the 29 antibiotics made in 1956, 17 came from one company.

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### Reichhold expansion in Europe

Capitalisation of three Reichhold chemical companies in Europe will be increased substantially, making possible major plant expansions for increased and more diversified production of basic chemicals and synthetic resins.

Capitalisation of the Swiss company, Oel and Chemie Werk A.G., will be doubled from 2·5 to 5 million Swiss francs, making possible construction of a new plant which will produce 3,000 tons of phthalic anhydride p.a.

Reichhold Chemie A.G., in Germany, will double its phthalic capacity following an increase in capitalisation from 4 to 5 million marks. Capitalisation of the French firm Reichhold-Beckacite S.A. will rise from 400 to 600 million francs as capacity for production of various chemicals is increased.

There are 37 Reichhold plants throughout the world, 10 of them in Europe.

## BRAZIL

### Bayer factory inaugurated

The President of the Republic has inaugurated the new factory of Bayer do Brasil Industria Quimica S.A., at Belfort Roxo in the State of Rio de Janeiro. The factory will produce aniline dyes, chemicals for the paper, textile and leather industries and some basic pharmaceuticals, as well as insecticides, weedkillers and other chemical products hitherto imported. It is a Farbenfabriken Bayer subsidiary.

### Fertiliser production

The Ferisa fertiliser plant near Araxa in the State of Minas Gerais is nearly ready to go into production. The raw material will be obtained from the large deposits of apatite at Araxa which will be calcined and mixed with phosphates from Pocos de Caldas to produce calcium and potassium phosphate. Initial capacity will be 200 tons of apatite daily, to be raised later to 600 tons.

# *New Products*

### Improved glycerin

The U.K. Glycerin Producers' Association Ltd., announces that the name of the grade previously sold as pale straw glycerin will in future be technical grade glycerin, and that the specific gravity of both chemically pure and technical grade glycerin has been increased from 1·260 to 1·2627. The new gravity will correspond to a glycerol strength of 99%. There will be no change in price from the introduction of the more concentrated material.

✶

### Potato sprout depressant

Nonanol is a new compound developed by Imperial Chemical Industries Ltd. to reduce the sprouting rate of potatoes stored indoors.

It is applied by a simple fumigation technique which, it is said, will ensure that healthy potatoes will be unwilted and free from sprouts at the time of marketing, even after lengthy storage.

The product is a higher alcohol consisting essentially of 3 : 5 : 5-trimethyl hexanol. Trial applications of Nonanol vapour to 900 tons of potatoes when the " eyes " were active are reported to have resulted in increased dormancy to the tubers.

Nonanol fumigation is complementary to the ventilation system recommended by the Ministry of Agriculture for indoor stores.

It is sold in 5 gal. drums at £4 7s. 6d. per drum. Approximately 100 tons of potatoes can be treated for a whole season with 40 gal.

✶

### Grass killer first product of Dow Agrochemicals

A new agricultural chemical manufacturing company has been established in Britain by the Dow Chemical Co. of America in partnership with Dr. W. E. Ripper, founder and former managing director of Pest Control Ltd., now Fisons Pest Control Ltd. Its headquarters are at 48 Charles Street, W.1, and its first aim is to manufacture a range of Dow agricultural specialities in Britain. The first product to be marketed is the new systemic grass weedkiller *Dowpon* which, it is claimed, can cheaply and easily solve the problems of farmers who face the creeping menace of couch grass. The active ingredient is 2,2 Dichloropropionic acid.

Couch grass, and certain other similar types of perennial grasses have become the main weed danger to British growers of cereal crops and to dairy farmers who depend on leys, since other chemical weedkillers satisfactorily control other weeds. Such weedkillers are generally ineffective against couch, which has hitherto only been kept rather inadequately in check by cultivation methods, which depend on dry weather in summer and autumn and make heavy demands on labour and tractor power.

*Dowpon* is claimed to be fully herbicidal to couch and similar grasses, and probably to bracken, and at a cost of £5 to £7 an acre; simple spray treatments with this chemical on the stubble in the autumn can rid the land of this weed without recourse to cultivations or fallowing.

A simple inexpensive barrier spray with *Dowpon* around the fields keeps them couch free, it is said.

*Dowpon* should increase cereal yields, improve pasture and lucerne production, simplify pasture renovation and aid horticulturalists, because it also kills couch under apple and pear trees, black-currants, in asparagus and other crops.

★

### Brushless mascara

Helena Rubinstein's *Mascaramatic* dispenses with the use of a brush. It is applied straight from a slim pen-like holder. There is a choice of three colours, black, brown and blue, and it retails at 15s. Refills will be available shortly.

## NEW COMPANIES

These particulars of new companies have been extracted from the daily register of Jordan and Sons Ltd., company registration agents, Chancery Lane, London, W.C. 2.

**Industrial Germicides Ltd.** 17.6.58. 224 Humberstone Road, Leicester. To take over bus. of a manfg. chemist cd. on at 10 Central Avenue, Leicester, by Geo. H. Muddimer, etc. £1,000. Dirs.: Geo. H. Muddimer, Geo. R. Goodman, Margaret R. Howe.

**Scalemaster Ltd.** 17.6.58. 27 John Adam Street, London, W.C.2. Mnfrs. of and dlrs. in filtering and purifying apparatus and plant and water treating and softening and scale prevention and removing plant and materials; mfg. and retail chemists and druggists, etc. £1,000. Dirs.: James R. Williams, A.M.I.E.E., and Reginald W. Hodges.

**Mallpas (Pharmaceuticals) Ltd.** 18.6.58. 12 Thayer Street, London, W.1. £100. Dirs.: Adrienne Phillips and Mrs. Vivienne Biedak.

**M. Appleyard Ltd.** 18.6.58. 602 Gt. Horton Road, Bradford. Chemists, etc. £500. Subs.: Mrs. M. Appleyard and D. Nolon.

**R. W. Smith (Chemists) Ltd.** 18.6.58. 10 Station Approach, Tadworth, Surrey. £3,200. Dirs.: Reginald W. Smith and Kenneth D. Vick.

**W. A. Stroyde (Chemists) Ltd.** 19.6.58. Lloyds Bank Chambers, Wolverhampton Street, Dudley. £4,000. Dirs.: Wm. A. and Mabel Stroyde.

**Glazebrook and Co. (London) Ltd.** 25.6.58. 110 Cannon Street, London, E.C.4. Importers and exporters of and dlrs. in chemicals, fertilisers, etc. £3,000. Dir.: Alfons G. Glazebrook.

# THE CHEMICAL MARKET

TARTARIC ACID DEARER; WAXES DOWN

LONDON.—The market has remained fairly steady except for a 10s. increase in the price of **tartaric acid,** bringing it up to £14 10s. cwt. The other changes occur in the gums and waxes section. Three grades of **beeswax** are reduced, Dar-es-Salaam spot (nominal) from £30 cwt. to £27 10s., Sudan spot from £29 to £27, and bleached white (slab) from £36 cwt. to £32 10s. Gum arabic, lump, is 10s. dearer, making it £7 10s. cwt. Peru balsam is 10s. 9d. against 11s. 9d. Shellac is also cheaper in most grades, so that No. 1 orange is £13 instead of £13 10s. cwt., No. 2 orange, formerly £11 15s. cwt., is £11 10s. and transparent white is 4s. 3d. against 4s. 4d. lb.

## FINE CHEMICALS

**Acetanilide**
12½ kg. 7s. 4d. kg.
**Arsenious oxide B.P.**
7-lb. lots 1s. 9d. lb.
1 cwt. lots 1s. 2d. lb.
**Ascorbic acid**
100 kg. £4 14s. kg.
**Aspirin**
56 lb. 5s. 2d. lb.
1-cwt. 4s. 11d. ,,
5-cwt. lots 4s. 9d. ,,
**Atropine**
Sulphate, 500 g. & £59 18s. 6d. kg.
Alkaloid, 500 g. £69 10s. kg.
**Benzene B.P.C.** 28-lb. lots 1s. 8d. lb.
**Benzoic acid** 12½ kg. 7s. 4d. kg.
**Benzyl benzoate**
According to pack 5s. to 5s. 6d. lb.
**Bismuth oxide B.P.C. 1934**
28-lb. lots 26s. 10d. lb.
**Bismuth salts** 28-lb. lots:
Carbonate 22s. 3d. lb.
Subgallate 21s. 1d. ,,
Salicylate 21s. 9d. ,,
Subnitrate 20s. 5d. ,,
**Borax B.P.**
Powder (hessian bags) £58 10s.
,, (paper bags) £57 10s.
Extra fine (hessian bags) £59 10s.
,, ,, (paper bags) £58 10s.
**Boric acid B.P.**
Crystal (hessian bags) £96 10s.
,, (paper bags) £95 10s.
Powder (hessian bags) £94
,, (paper bags) £93
**Bromine B.P.C.**
7-lb. lots 6s. lb.
**Caffeine** 50 kg. 42s. 6d. kg.
**Calamine** 50 kg. 4s. kg.
**Calcium gluconate**
1 cwt. lots dlvd. 3s. 7d. lb.
**Calcium glycerophosphate**
50 kg. 28s. 6d. kg.
**Calcium lactate B.P.**
7-lb. lots 3s. 6d. lb.
1-cwt. lots 2s. 11d. ,,
**Chloral hydrate** 50 kg. 10s. kg.
**Citric acid, B.P.**
Powder or granulated:
1-cwt. lots £11 5s. cwt.
5-cwt. lots £11 ,,
**Codeine**
Alkaloid 100 g. £106 7s. 6d. kg.
Phosphate 100 g. £110 ,,
**Ephedrine** 500 g. lots
Hydrochloride 3 kg. £6 12s. 3d. kg.
Alkaloid 3 kg. £12 7s. kg.
Sulphate 3 kg. £6 12s. 3d. ,,
**Eucalyptol**
1-cwt. lots 12s. 6d. lb.
5-cwt. lots 12s. ,,
**Ferri ammonium citrate B.P.**
1-cwt. lots, scales 4s. 8d. lb.
1-cwt. lots, granules 3s. 11d. ,,
**Ferrous gluconate**
1 cwt. lots dlvd. 6s. 3d. lb.
**Gallic acid B.P.C.**
1-cwt. lots 9s. 8d. ,,
**Glycerophosphoric acid**
24 litres 11s. 10d. litre
**Glycine (amino acetic acid)**
12½ kg. 18s. 10d. kg.
**Hexyl resorcinol** 10 kg. £7 10s. kg.
**Hydroquinone** 12½ kg. 23s. 10d. kg.
**Iodides**
Ethyl
4 kg. bottles 62s. 9d. kg.
Mercury, red B.P.C.
28-lb. lots 27s. lb.
1-cwt. lots 26s. ,,
Potassium B.P.
28-lb. lots 8s. 6d. ,,
1-cwt. lots 8s. 3d. ,,
Sodium B.P.
28-lb. lots 13s. ,,
1-cwt. lots 12s. 9d. ,,
**Iodine, Chilean** crude,
99% min. in wooden casks 15s. kg.
**Iodoform**
12½ kg. and under 50 kg. 42s. 6d. kg.
**Lactose** 50 kg. 3s. 2d. kg.
**Lithium salts** 5-cwt. lots
Benzoate 10s. lb.
Carbonate B.P.C. 11s. 3d. ,,
Chloride (commercial) powder 11s. ,,
,, granular 10s. 9d. ,,
Hydroxide 9s. 9d. ,,
Citrate B.P.C. 9s. ,,
Sulphate 8s. 6d. ,,
Salicylate, 10 cwt., dlvd. 9s. 9d. ,,
**Magnesium carbonate B.P.**
Light cwt. lots dlvd. £129 ton
**Magnesium trisilicate**
28-lb. packages
28-lb. lots 4s. 3d. lb.
1-cwt. lots 3s. 10d. ,,
5-cwt. lots 3s. 7d. ,,
Bulk rates for larger quantities are from 3s. 1d. lb. in 1 ton lots
**Manganese hypophosphite B.P.C.**
7-lb. lots 13s. 11d. lb.
1-cwt. lots 12s. 11d. ,,
**Mercuric chloride B.P.**
50-kg. lump 48s. 6d. kg.
**Methyl salicylate** 1-cwt. lots 3s. 3d. lb.
**Morphine**
Alkaloid, 100 g. £138 18s. 4d. kg.
**Nicotinamide** 1 kg. £4 10s. kg.
**Nicotinic acid**
12½ kg. 52s. 6d. kg.
1 kg. 55s. ,,
**Oleine, B.P.** extra pale, 3/4 cwt. drums returnable carriage paid G.B. £160 ton
**Phenolphthalein** 50 kg. 24s. 3d. kg.
**Phosphoric acid B.P.**
(s.g. 1·750) 10 carboy lots 1s. 4d. lb.
**Potassium permanganate B.P.**
1-cwt. lots dlvd. 1s. 11¼d. lb.
**Procaine hydrochloride** (foreign) 2 kg. 59s. kg.
**Quinine** 1 oz. lots 4s. 4d. oz.
**Riboflavin**
100 g. 5½d. g.
10 g. 7d. ,,
**Saccharin**
500 g. £7 4s. for this quantity
**Salicylic acid**
B.P., dlvd. 3s. 2½d. to 5s. 6d. lb.
**Silver nitrate**
500 g. 4s. 11½d. oz.
**Sodium benzoate B.P.**
1-cwt. lots 2s. 9½d. lb.
1-ton lots 2s. 7½d. ,,
**Sodium salicylate**
50 kg. 8s. 8d. kg.
12½ kg. 9s. ,,
**Sodium thiosulphate**
Crystals, photographic quality
1-ton lots 49s. cwt.
**Stearic acid B.P.C.** flake, carriage paid G.B. £154 ton
**Strychnine** 25 oz.
Alkaloid 5s. 10d.
Hydrochloride 4s. 11d.
Sulphate 4s. 11d.
**Sulphaguanidine**
12½ kg. 33s. kg.
50 kg. 32s. ,,
**Sulphanilamide**
12½ kg. 16s. 6d. kg.
50 kg. 15s. 4d. ,,
**Sulphathiazole** 12½ kg. 39s. 9d. kg.
**Tannic acid B.P.** Levis
1-cwt. lots 10s. lb.
**Tartaric acid B.P.**
Powder or granulated,
10 cwt. or more £14 10s. cwt.
**Terpineol, B.P.**
40-gal. drums 2s. 5d. lb.
1-cwt. lots 2s. 8d. ,,
**Theophylline, B.P.**
500 g. 27s. 6d. for this quantity
**Thiamine hydrochloride**
100 g. 4d. g.
1 kg. £13 7s. 6d. kg.
**Thioglycollate**
Ammonium 12s. 4d. to 16s. 4d. lb.
Calcium:
7-lb. lots 17s. 3d. ,,
5-cwt. lots 14s. 3d. ,,
**α-Tocopherol** 25-g. lots 1s. 1d. g.
**Vanillin** 26s. to 30s. 6d. lb.
**Zinc oxide, B.P.**
2-ton lots £102 ton

## GENERAL CHEMICALS

**Acetic acid** 1-ton lots dlvd.
80% Technical £99 ton
80% Pure £105 ,,
Glacial B.P. £114 ,,
99-100% Glacial £111 ,,
98-100% Glacial £108 ,,

**Acetic anhydride**
1-ton lots dlvd. £143 ton

**Acetone**
5-gal. drums, free, non-returnable £128 ton
40 to 45-gal. drums, 10-ton lots £88 „

**Alum, potassium** granular crystals
50 kg. 1s. 2d. kg.

**Aluminium hydroxide** B.P.C. 34
28-lb. lots 2s. 4d. lb.

**Aluminium stearate**
(Precipitate) 1-ton lots £258 10s. ton

**Ammonia**
Persulphate £6 2s. 6d. cwt.
Phosphate: Mono- £106 ton
Di- £100 „

**Amyl acetate**
B.S.S. 10 tons and over £251 ton
Technical £249 „

**Amyl alcohol**
Technical in 1-ton lots £260 ton

**Arsenic** White powdered ex store £37-£38 ton

***n*-Butyl acetate**
10-ton lots £173 ton

***n*-Butyl alcohol**
10-ton lots £142 ton

**Calcium chloride**
Solid 70 to 72%, 4-ton lots dlvd. £17 10s. ton

**Calcium oxide (Lime)**
Ex marble 28-lb. lots 3s. 10d. lb.

**Caustic soda**
Solid 1-ton lots, from £37 0s. 6d. ton

**Chloroform B.P.** ½-ton lots 3s. 1½d. lb.

**Chromic acid**
Dlvd. U.K. (less 2½%) 2s. 0¼d. to 2s. 0¾d. lb.

**DDT** 3s. 0½d. to 3s. 2d. lb.

**2 : 4-Dichlorophenoxyacetic acid**
99% pure, 1-cwt. bags £340 ton

**Dimethyl sulphate** 400 lb. drum lots 1s. 8d. lb.

**Ether (Di ethyl ether)**
Tech. B.S.S. and Solvent B.P.
1-ton lots in drums 2s. lb.

**Ethyl acetate** 10-ton lots £145 ton

**Ethyl alcohol**
95% Gay Lussac 66·0 o.p.
2,500 to over 300,000 proof gallons per year in tank wagons
4s. 2¾d. to 4s. 0¼d. per proof gal.

**Ferrous sulphate** 50 kg. 1s. 4d. kg.

**Formaldehyde**
40% by volume dlvd. England
1-ton lots £38 15s. ton

**Glycerin**
1,260 s.g. chem. pure, 5 tons and up, 5-cwt. drums £201 10s. ton
1,260 s.g. refined pale straw, indus., 5 tons and up, 5-cwt. drums £196 10s. ton

**Hexamine**
1-ton lots
Technical, bulk 1s. 8d. lb.
B.P.C. 1s. 11d. „

**Hydrochloric acid**
Commercial 18s. 6d. cwt.

**Hydrogen peroxide**
27·5% weight £128 10s. ton
35% weight £158 „

**Lactic acid** (1-ton lots)
Pale tech. 44% by weight 1s. 3¼d. lb.
Dark tech. 44% by weight 9¼d. lb.

**Magnesium chloride**
Solid (ex wharf): 1-ton lots £17 10s. ton

**Magnesium sulphate** £14 10s. to £15 5s. ton

**Mercurous chloride (calomel)**
50 kg. 65s. kg.

**Mercury sulphide, red**
Ton lots and over 30s. 6d. lb.

**Methylated spirits (Industrial)**
Perfumery quality 500 gal. and upwards:
61 o.p. 7s. 4d.
74 o.p. 7s. 11½d.
5 to 10 gal.:
61 o.p. 8s. 8d.
74 o.p. 9s. 3½d.

**Methyl ethyl ketone**
10 tons dlvd. in drums £143 ton

**Methyl isobutyl carbinol**
10 tons and up, in drums, dlvd. £163 ton

**Methyl isobutyl ketone**
10 to 50 tons, in drums, dlvd. £169 ton

**Naphthalene**
Crystal, dlvd., 4-ton lots, spot £65 4s. 3d. ton
Ball and flake (ditto) £73 14s. 3d. „

**Nickel sulphate**
dlvd. ton lots £195 10s. ton

**Nitric acid** 70% intermediate £32 „

**Pentachlorphenol**
Flake, technical, 1-ton lots, dlvd. 2s. 2d. lb.

**Phenol** Crystals:
Under 1 ton dlvd. from 1s. 7d. lb.
10 tons and over dlvd. in returnable drums from 1s. 4½d. lb.

**Phthalates**
10 ton lots in drums
Diethyl (B.S.) £187 10s. ton
Dimethyl (B.S.) £179 ton

**Potassium bromide**
50 kg. 5s. 6d. kg.
12½ kg. 5s. 8d. „

**Potassium carbonate**
Calcined 96 to 98% (1-ton lots ex store) £76 ton
Hydrated (1-ton lots) £74 10s. „

**Potassium fluoride**
28-lb. lots 5s. 1d. lb.

**Potassium sodium tartrate**
5-cwt. lots £10 cwt.

**Soda ash**
1-ton lots dlvd., from £17 10s. 6d. ton

**Sodium cyanide**
96-98% £128 ton

**Sodium hydroxide** 28 lb. lots:
sticks (1 lb. bottles) 4s. 3d. lb.
pellets „ „ 3s. 9d. „

**Sodium metal** 28-lb. lots 3s. 8d. „

**Sodium metasilicate**
Dlvd. U.K. in ton lots £26 ton

**Sodium phosphate**
Dlvd. ton lots: Di-sodium, crystalline £40 10s. ton
Anhydrous £88 „
Tri-sodium, crystalline £39 „
Anhydrous £86 „

**Sodium silicate**
according to quantity, grade and delivery point
4 ton lots £13 10s. ton
1 ton lots £15 „

**Sodium sulphate** Ex works:
(Glauber salt) £13 ton
(Salt cake) unground, full truck loads £8 16s. 6d. ton

**Sodium sulphide**
Broken, returnable drums, dlvd. ton lots £37 2s. 6d. ton
Flake, ditto £38 12s. 6d. „
Solid ditto £36 2s. 6d. „

**Sodium sulphite**
Commercial crystals 4-ton lots £24 10s. „
(Dlvd. London in 1-cwt. single non-returnable bags)

**Sodium tripolyphosphate**
1-ton lots £95 ton

**Stannic chloride** 28-lb. lots 8s. 11d. lb.

**Stannous chloride** 28-lb. lots 9s. 5d. lb.

**Strontium carbonate**
96-98% 28-lb. lots 3s. lb.

**Sulphuric acid**, ex-works, according to quality and quantity
B.O.V. 78% from 8s. to 10s. cwt.
C.O.V. 96% from 11s. to 14s. cwt.

**Zinc chloride**
28-lb. lots sticks 6s. 9d. lb.

## OILS AND FATS

**Palm kernel oil**
Refined, deodorised, 2-ton lots, naked, ex works £118 ton

**Palm oil**
Refined, deodorised, 2-ton lots, naked, ex works £108 ton

**Stearine**
dlvd. free bags
Pristerene 64 flake £148 ton
Pristerene 62 flake £133 „
Pristerene 61 flake £113 „
A premium of £2 ton is charged for powder and £4 for block

## GUMS AND WAXES

**Agar Agar No. 1**
Kobe strip 12s. 3d. lb.
Powder 17s. 6d. „

**Beeswax**
Dar-es-Salaam spot (nominal) £27 10s. cwt.
Sudan spot (duty paid) £27 „
Bleached white (slab) £32 10s. „
Refined yellow (slab) £29 „

**Benzoin**
Sumatra spot £27 cwt.
Siam spot (nominal) £2 7s. 6d. lb.

**Candelilla** Spot £24 10s cwt.

**Carnauba**
Prime, Spot £51 cwt.
Fatty grey £28 10s. „

**Gum arabic** Lump £7 10s. cwt.

**Karaya** Powder, Spot 3s. 6d. lb.

**Paraffin wax**
1-ton lots, acc. to grade £87 10s. to £120 ton

**Peru balsam** 10s. 9d. lb.

**Shellac**
No. 1 orange £13 cwt.
No. 2 orange £11 10s. „
Transparent white 4s. 3d. lb.
Pale dewaxed 6s. „

**Tragacanth**
No. 1 spot £130 cwt.
No. 2 spot £121 „
Pale leaf £49 „
Amber £38 „
Brown to Red £28 „

# NEW PATENTS

COMPLETE SPECIFICATIONS ACCEPTED

## Pharmaceuticals

Heterocyclic nitrogen - compounds. *Smith and Nephew Ltd.* 801,792.

Derivatives of piperazine and the manufacture thereof. *Wellcome Foundation Ltd.* 802,080.

Derivates of triazine and the manufacture thereof. *Wellcome Foundation Ltd.* 802,122.

Compositions for use as local anæsthetics. *May and Baker Ltd.* 802,023.

Pharmaceutical preparations. *H. Rabinovitch.* 801,726.

Manufacture of cyanoformamide. *American Cyanamid Co.* 801,954.

Trypanocidal agents. *Boots Pure Drug Co. Ltd.* 802,533.

Vaccine products and method for producing same. *Parke, Davis and Co.* 802,048.

Alkaloid and a process for its isolation. *Ciba Ltd.* 801,541.

## Dyestuffs

Metallisable monoazo dyestuffs of the benzene-azo-4-hydroxybenzthiazole series. *Imperial Chemical Industries Ltd.* 801,900.

Metallisable monoazo dyestuffs of the benzene-azo-indiazole series. *Compagnie Francaise des Matieres Colorantes.* 802,076.

Disazo dyestuffs derived from 4,4′-diamino-3,3′-dicarboxydiphenol. *Farbenfabriken Bayer A.G.* 802,097.

Anthraquinone vat dyestuffs and process for manufacture. *Ciba Ltd.* 802,681.

Chromium complexes of o : o′ dihydroxymonoazo dyestuffs of the benzene-azo-naphthalene series. *Imperial Chemical Industries Ltd.* 802,458.

## Detergents, soaps, etc.

Detergent compositions. *T. Hedley and Co. Ltd.* 802,302.

Surface-active agents. *Farbenfabriken Bayer A.G.* 802,642.

Stabilised soap-containing compositions. *Olin Mathieson Chemical Corp.* 802,447.

## Cosmetics and toilet preparations

Neutralising agents for permanent waving of human hair. *Evans Chemetics Inc.* 801,990.

## Pesticides, fungicides, etc.

Non-toxic pesticidal compositions. *I. I. Lubowe.* 802,111.

Benztriazole derivatives and fungicidal compositions containing them. *J. R. Geigy A.G.* 802,096.

Insecticidal compositions. *Union Carbide Corporation.* 802,741.

## Steroids

6-Methyl-steroid compounds. *British Drug Houses Ltd.* 802,003, 802,004.

Steroid compounds. *Merck and Co. Inc.* 801,829.

Steroid compounds. *British Drug Houses Ltd.* 801,793, 801,794.

Steroids and their manufacture. *Upjohn Co.* 801,503, 801,614.

# NEW TRADE MARKS

APPLICATIONS

## Cosmetics and toilet preparations

RACING RED.—771,654. *Coty (England) Ltd.*

JUNGLE GLO. — 775,287. *Richard Hudnut.*

DELIAL.—765,640. *Farbenfabriken Bayer A.G.*

PLIX.—773,712. *Société Monsavon-L'Oreal.*

ORBIT.—774,273. *Coty (England) Ltd.*

SECRET SET.—B776,774. *Florogen Ltd.*

PRIMITIF.—772,992. *Max Factor and Co.*

CONTACT.—B774,120. *Rilling-Hills Ltd.*

SOIR DE BAL.—775,875. Soaps, perfumes and non-medicated toilet preparations. *F. M. Langford Ltd.*

FIRST LADY. — 771,335. *David Mosseri.*

OH LA LA.—775,610. *Richard Hudnut.*

FUN.—777,102. *Goya Ltd.*

EVER.—774,254. *Joseph Watson and Sons Ltd.*

## Pharmaceuticals

KANTREX.—773,849. *Bristol Laboratories Inc.*

ZYLCOIDS.—774,185. *Boots Pure Drug Co. Ltd.*

SUPRIFEN. — 774,277. *Farbwerke Hoechst A.G.*

NAZOSPRIN. — 775,083. *Wellcome Foundation Ltd.*

CETOCORT.—775,558. *Genatosan Ltd.*

MICRONIL.—775,602 RISTOCIN.—776,011. *Imperial Chemical Industries Ltd.*

STIMALGIN.—776,167. *Clinical Products Ltd.*

GYNOVULES.—776,677. *Rougier Inc.*

COSULID.—777,520. *Ciba Ltd.*

OVILLIN.—777,540. *Glaxo Laboratories Ltd.*

SINAXAR.—777,575. *Armour and Co.*

AURALGAN.—B681,289. *Doho Chemical Corp.*

HEALTHFARM. — B753,889. *R. Brooks and Co.*

YEASTOBIK.—768,080. *John Denman Dean.*

ALARTONE.—766,598. *Vick International Ltd.*

ALBUSTIX.—768,981. *Ames Co. Inc.*

SOLCODAN.—772,336. *Clinical Products Ltd.*

DURULES.—773,823. *A/B Hassle, Apotekare Paul Nordstroms Fabriker.*

ARCANOL.—775,934. *Warner-Lambert Pharmaceutical Co.*

HELMOLVIS. — 775,720. *Imperial Chemical Industries Ltd.*

GERANTIN.—775,935. *Warner-Lambert Pharmaceutical Co.*

DISTALGESIC.—776,413. *Distillers Co. (Biochemicals) Ltd.*

HORMEX.—776,576. *Smith Kendon Ltd.*

DE-OL.—771,553. *Domestos Ltd.*

ERGALAN.—773,627. *British Drug Houses Ltd.*

EPISOL.—773,841. *Crookes Laboratories Ltd.*

REVILLAIRE. — 774,127. *Richard Harvey Richards.*

WAMPOLE.—B774,317. *Henry A. Wampole and Co. Ltd.*

RAINBOVITE. — 774,483. *Medo-Pharma Ltd.*

ZELST.—774,916. *J. and J. Ballard.*

RISTON.—775,820. *Imperial Chemical Industries Ltd.*

ODO-MATIC. — 775,606. *Northam Warren Ltd.*

GALA.—765,632. *Gala of London.*

DENCO.—768,255. *Denver Chemical Mfg. Co.*

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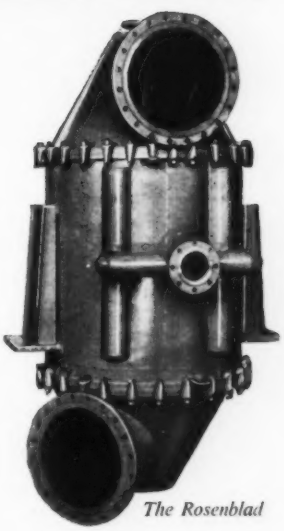

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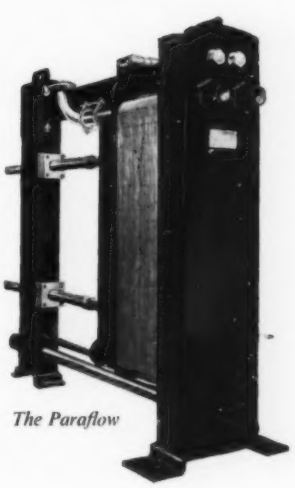

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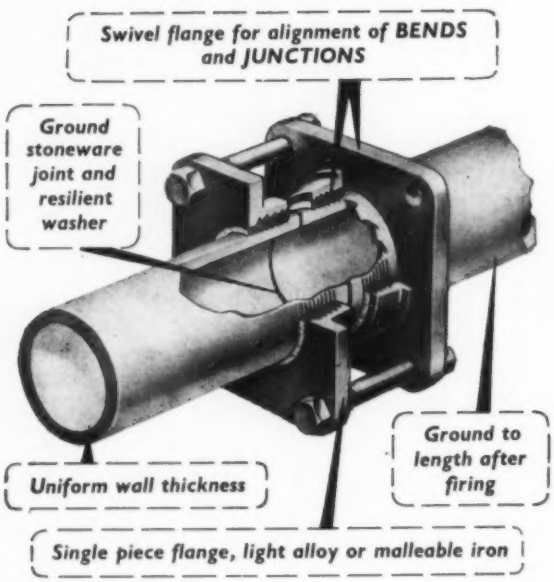
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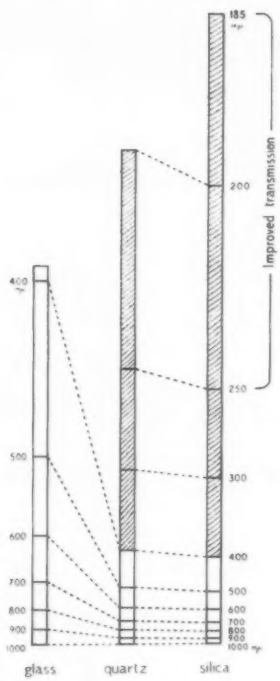


The diagram shows the relative dispersions and ranges of the Uvispek's three prisms and marks the region in which the new prism is more transparent than the quartz.

The new prism is interchangeable with the glass and quartz prisms, so if you have a Uvispek you can extend your work further into the ultra-violet, and have greatly improved results throughout the region down to 1,850 angstroms.

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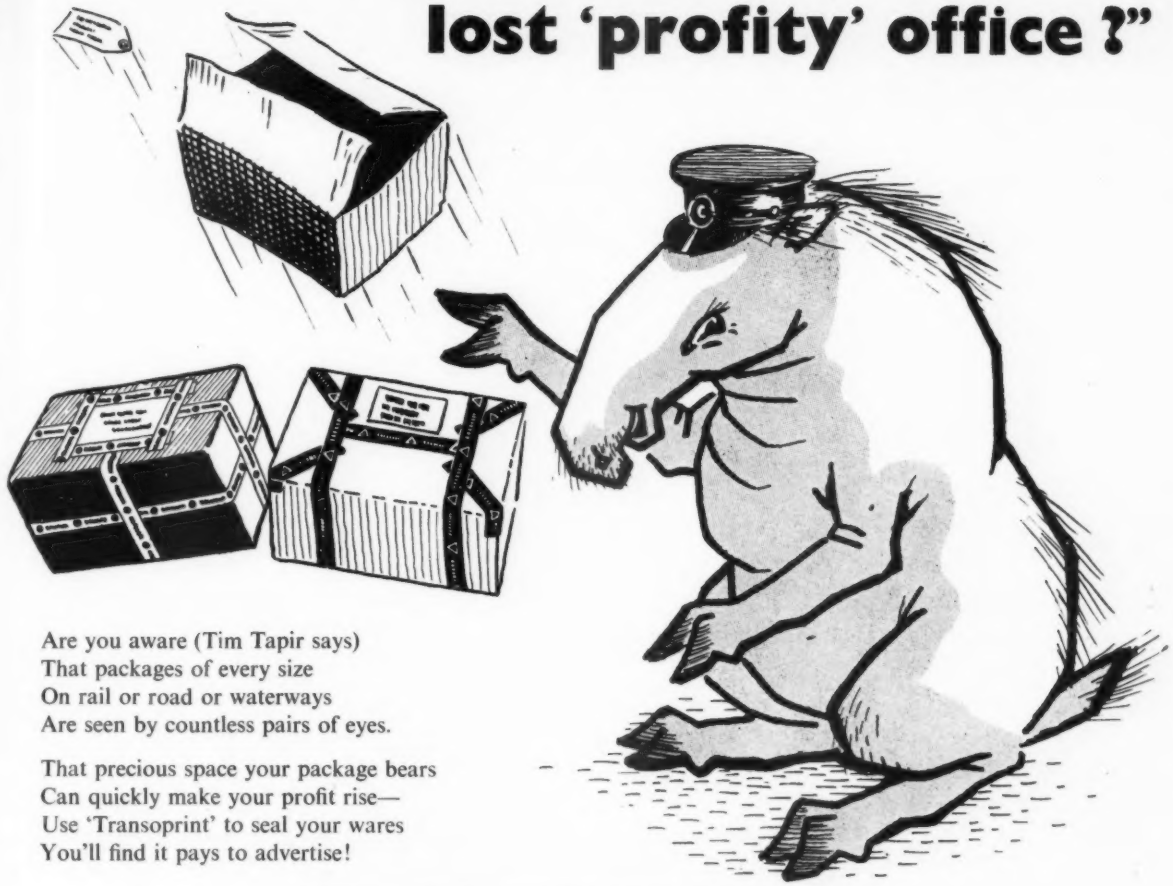

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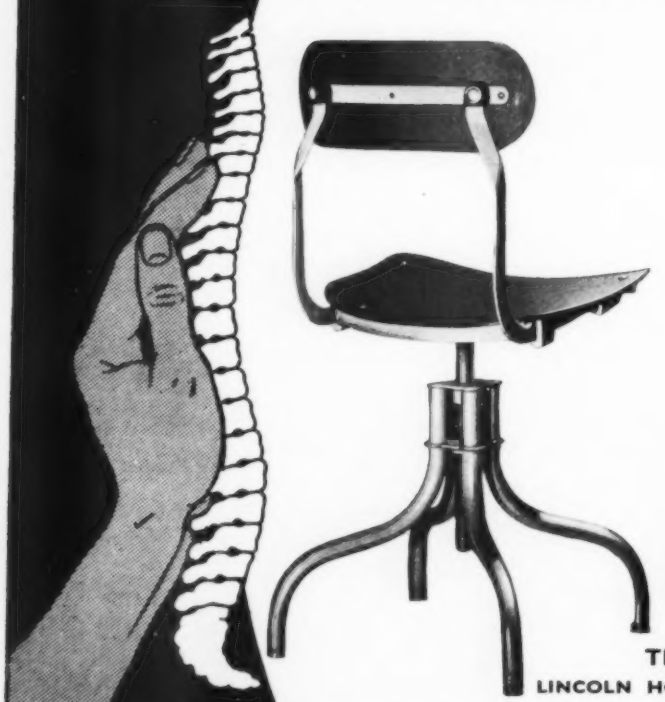

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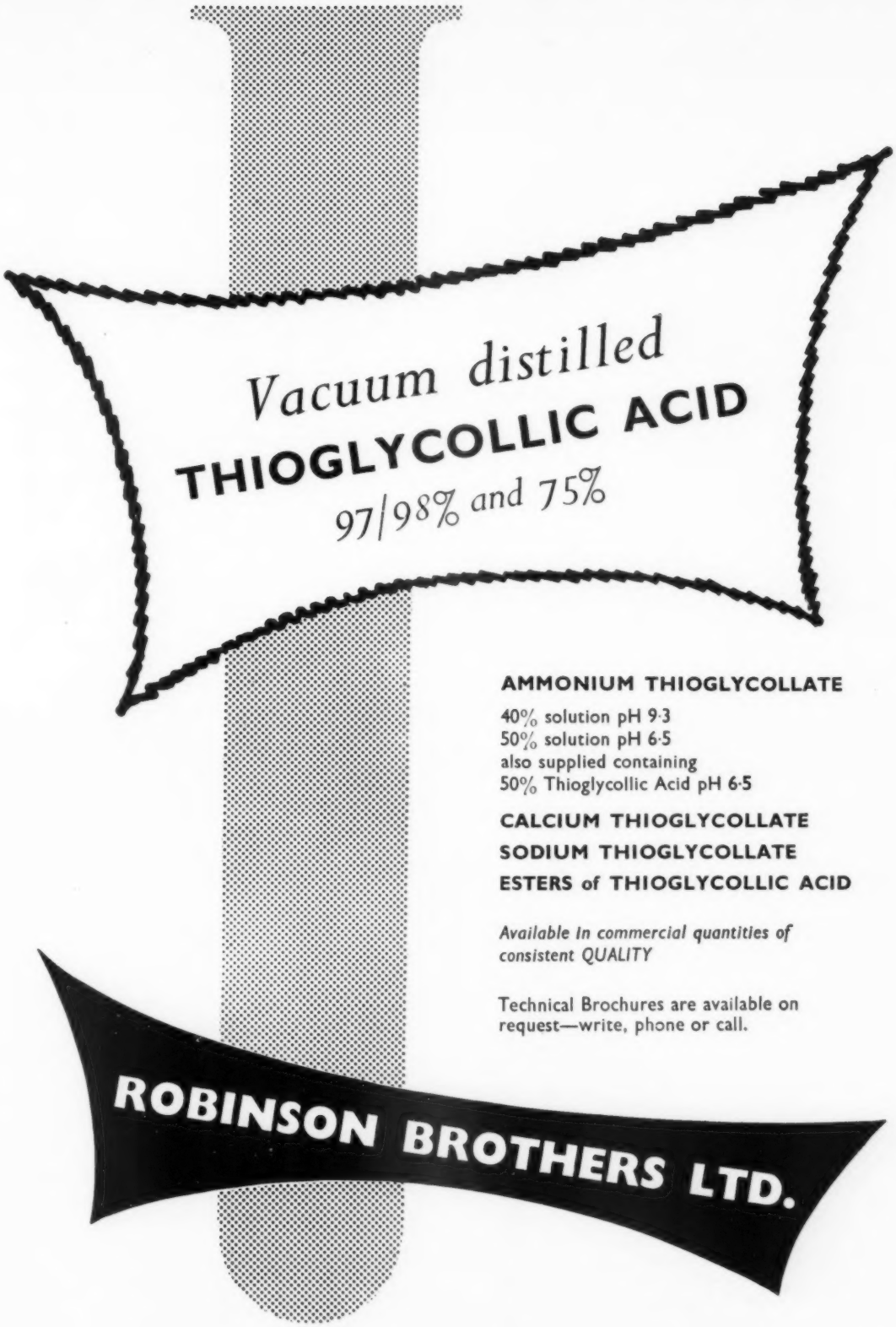
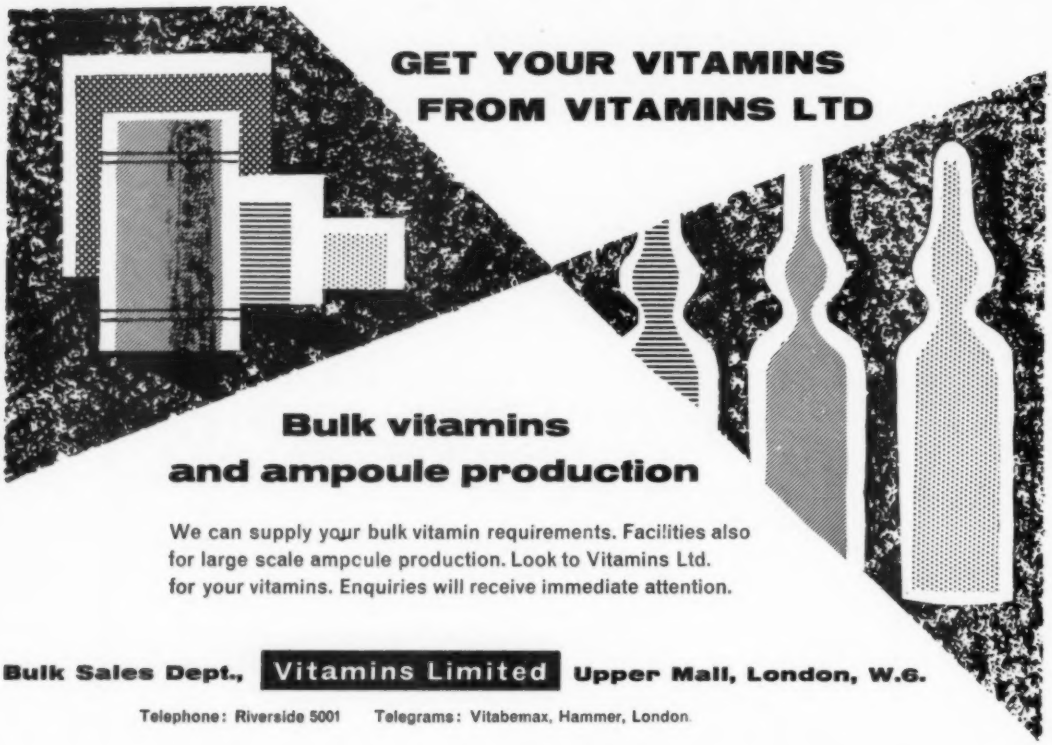



**ROBINSON BROTHERS LIMITED,** RYDERS GREEN, WEST BROMWICH. *Tel: West Bromwich 2451/3*

M-W. 59



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★ Speedy application, either semi- or fully-automatic.

★ Wide range of standard colours or special shades to match your labels.

***Why not send us a bottle of your product to be capsuled and returned to you with full particulars?***

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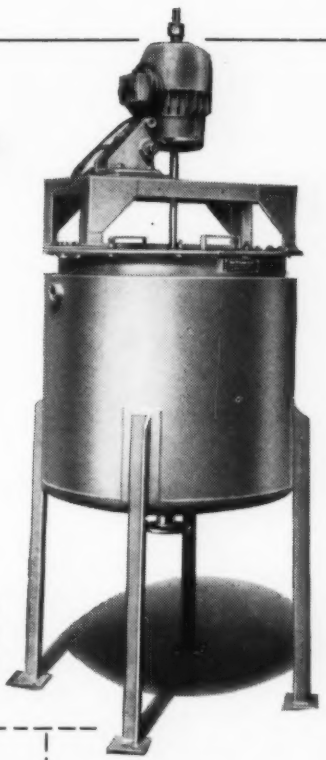

BUTTERFIELDS also fabricate in Mild Steel, Aluminium Nickel and 'Monel'

Above: Stainless Steel Mixing Vessel for Spun dyed yarn plant.

Left: Stainless Steel Separators.

**We are equipped with Weld X-Ray Plant, materials testing and microscopic examination facilities**

***Please mark all enquiries relating to this advertisement as follows: MC/9.***

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**laboratory**

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The mortars and pestles are interchangeable. A ceramic set can be used to process material adversely affected by contact with metal and a metal set, either high-grade cast iron or stainless material for which ceramic is unsuitable. The pestles are arranged to swing clear of or lift out of the mortars to facilitate emptying and cleaning.

The models illustrated are the new No. 0 model with a 6" mortar and the No. 2 model with a 15" mortar.

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An ideal, effective and well tried ingredient for analgesic and anti-rheumatic balms where an almost odourless end product is required. This material is also now finding a use in sun screening preparations.

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**AT 1,000 BOTTLES PER HOUR**

***without waste***

The ALBRO SINGLE-HEAD JUNIOR FILLER illustrated fills perfume for Mikado & Co. of Colombo, Ceylon.

Vacuum-operated, this Albro model is widely used by leading industries for filling *all* liquids and semi-liquids, including oils, emulsions, acids, syrups and spirits, in addition to perfumes.

Bottles ranging from 1 oz. to 4 oz. at a pre-determined level can be filled at approximately 8-10 gross per hour.

Designed for quick cleaning, the Albro liquid filler can easily be switched from one product to another, thus reducing filling costs to a minimum.

*Ask for details or a demonstration*

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**FOR LIQUIDS, POWDERS AND PASTES**

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*Bottle Washing Machine treated with Evokote Type 21 at the Streatham, London, factory of Messrs. United Dairies Ltd.*

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✳ *Proof against mineral and organic acids, gases, steam, caustic soda, detergents, abrasion.*

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**EPIKOTE RESIN BASED PAINTS**

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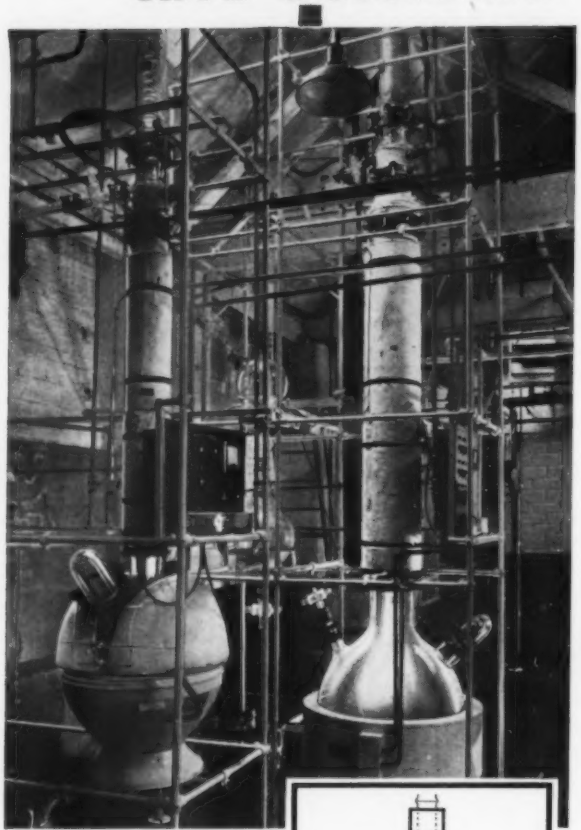
M-W.86

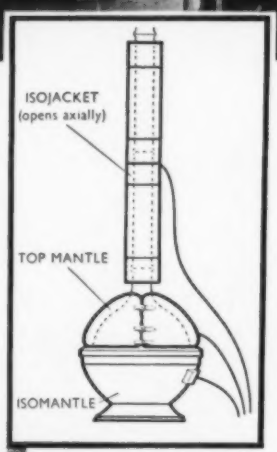
# ISOMANTLES

## *on glass flasks and columns*



Glass flasks up to 200 litre capacity are heated *safely* with Isomantles up to 400°C. All stresses in mounting and supporting large flasks are eliminated. Temperature control can be manual or automatic. "Flameproof" areas are provided for. The Isomantles in the above illustration heat Q.V.F. plant at the Birmingham Chemical Company, Limited — Can they help you?

Catalogue LM describes Isomantles for Glass Plant, and new 44 page catalogue details Industrial Heating Mantles, Tapes, etc.

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**ISOPAD LTD., Barnet By-Pass, Boreham Wood, Herts.**

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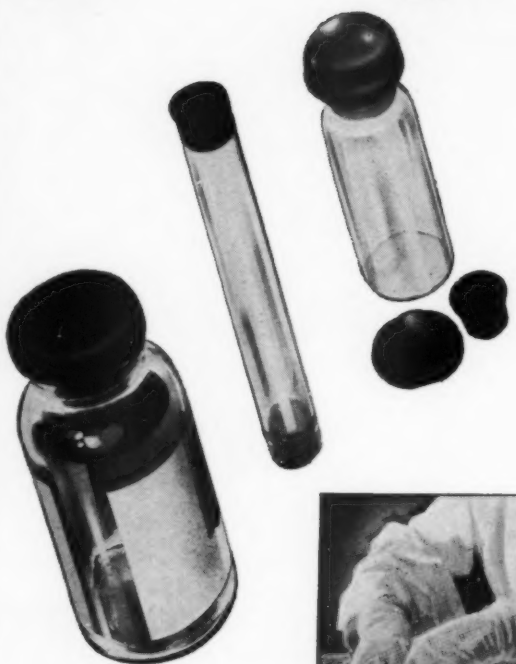

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98/100% about 16·2% Nitrogen

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| SAFETY | hazardous liquid baths not required. |
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Photograph by courtesy of May & Baker Ltd.
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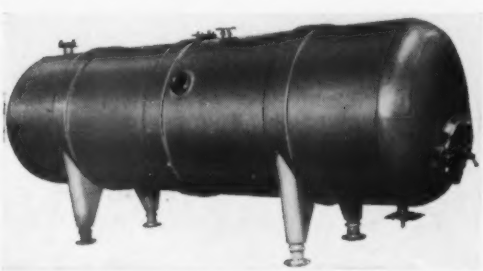
Plant and Equipment Engineers to the Chemical and Food Industries.



Stainless steel horizontal storage vessel.

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**...solvent recovery by** SUTCLIFFE SPEAKMAN

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## Clean air and lower handling costs for Carlsberg

*Photo by courtesy of Carlsberg Distributors Ltd., London.*

In a peak month 650,000 *dozen* bottles of the famous Carlsberg Lager pass through the Carlsberg London depot. This big handling job is done quickly, and at the lowest cost ever, by Hyster fork lift trucks specially designed to run on L.P. (Liquid Petroleum) gas*. With no noxious fumes to endanger stock or personnel. Hyster handling—*right in the heart of the depot*—is quicker and cheaper than any other possible method. Ask our representative for a demonstration.

* *Supplied by Bottogas Ltd, 76-86 Strand, London, W.C.2*

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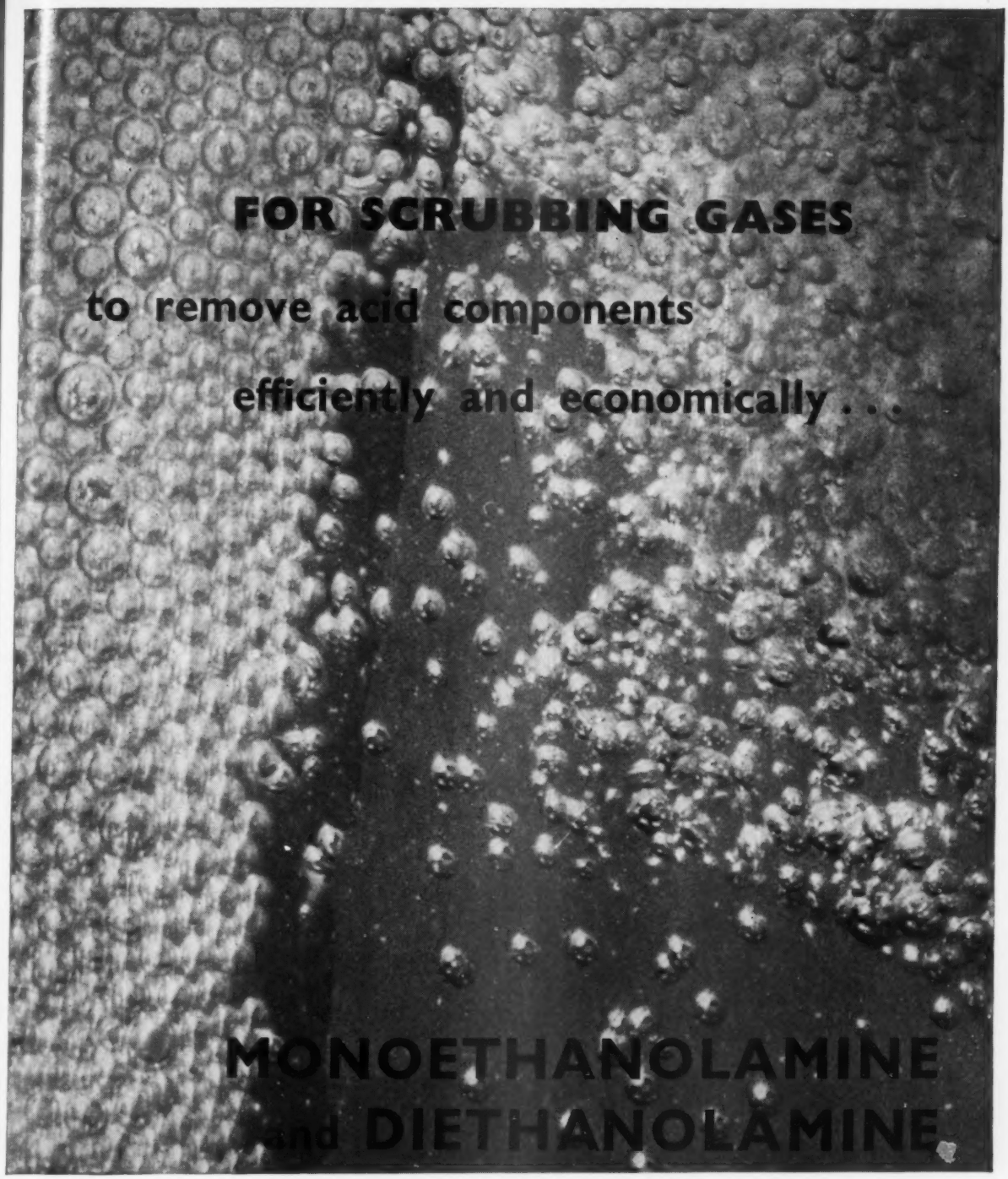


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*(Tetrahydro-1,4-Oxazine)*

***Properties:***
Morpholine is a colourless, mobile liquid with a characteristic ammoniacal odour. It is completely miscible with water and boils without decomposition at about 129° C. Morpholine is both a secondary amine and a cyclic ether and is therefore a useful and effective solvent for a wide range of resins, waxes, organic pigments and dyes. Aqueous solutions of Morpholine are unusual in that they evaporate with little change in composition.

***Applications:***
Apart from its many uses as a solvent Morpholine soaps formed by its reaction with fatty acids are excellent emulsifying agents and find wide application in the manufacture of paints, lacquers, wax polishes, and other surface coatings. It is also of use as a corrosion inhibitor and, together with its N-substituted derivatives, has many applications in the synthesis of pharmaceuticals, dye-stuffs and rubber chemicals, etc.

## A.M.P.

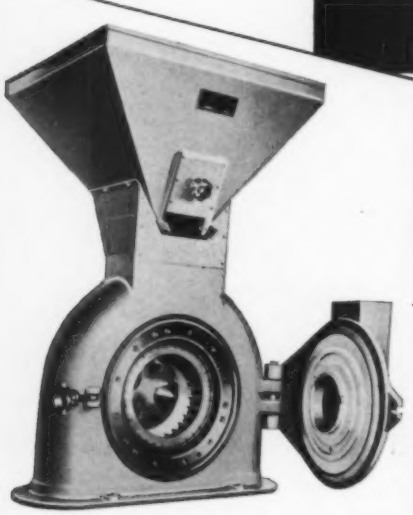
*(2-Amino-2-Methyl-1-Propanol)*

***Properties:***
A.M.P. occurs as a soft colourless mass of low melting crystals having a slight ammoniacal odour. It is completely miscible with water and many organic solvents. It boils without decomposition at about 165° C. and aqueous 0.1 M solutions at 20° C. have a pH of 11.3.

***Applications:***
Fatty acid soaps prepared from A.M.P. and Oleic acid have been available in the United States for some time. They are powerful emulsifying agents which are particularly suitable for the preparation of bright drying shoe and floor polishes, car polishes, cosmetic creams and lotions, textile specialities and other types of wax, resin and oil emulsions. A.M.P. is also of interest for chemical synthesis, especially in the manufacture of photographic developers, pharmaceuticals, dyestuffs and vulcanization accelerators for rubber. The substituted oxazolines, which have interesting surface active properties, are also directly derived from A.M.P. and its homologues.

*Samples, prices and technical literature available on application.*

WITH OVER 25 YEARS GRINDING EXPERIENCE WE SHOULD KNOW **25**



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*Designed with electro magnetic or mechanical feeding devices*

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*SCAN PACKING FOR SENSITIVE PRODUCTS*
*The name Scan guarantees a pure folding box board produced by the associated box board manufacturers of Finland, Norway and Sweden.*

# SCAN PURE FOLDING BOX BOARD

*Ask your boxmaker or agents of the* FINNISH, NORWEGIAN AND SWEDISH FOLDING BOX BOARD MILLS, OR WRITE TO THE SCAN INFORMATION & RESEARCH DEPT., P.O. BOX 7232 STOCKHOLM 7.

CVS-13a

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*CONTROLLED PRESSURE*
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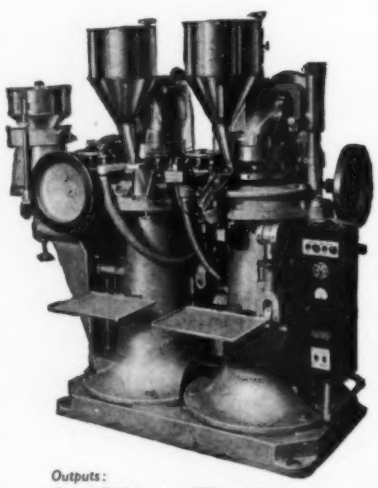

*Outputs:*
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*Maximum diameter coated tablets: $\frac{13}{16}$ inch*
*Variable Speed Drive. 2-h.p. motor*
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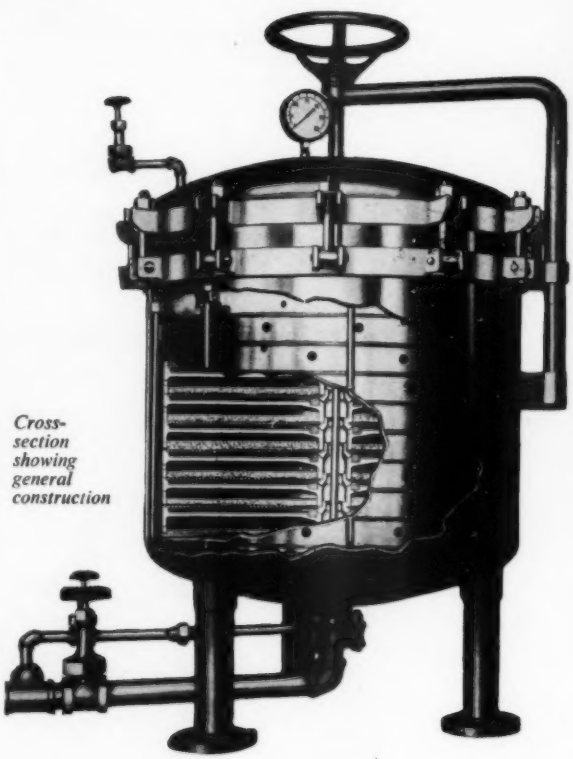

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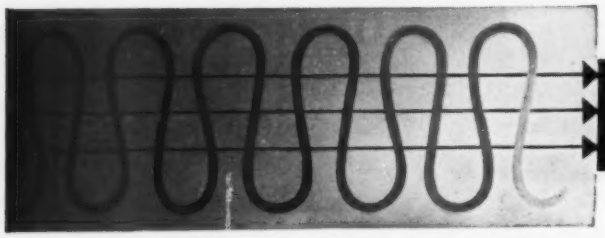

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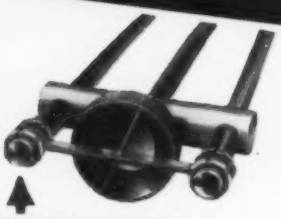

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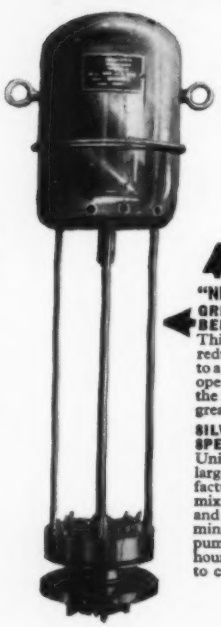

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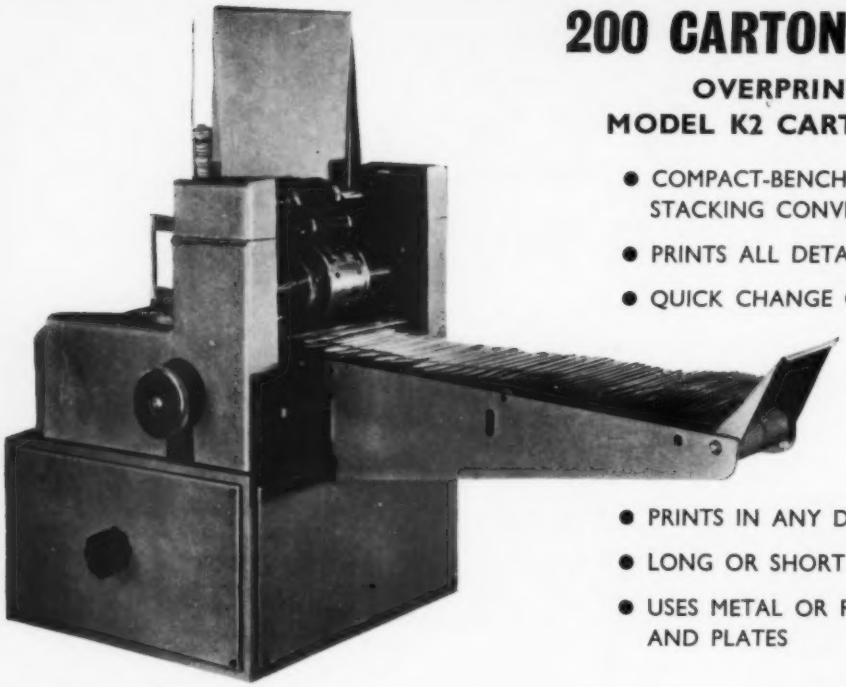

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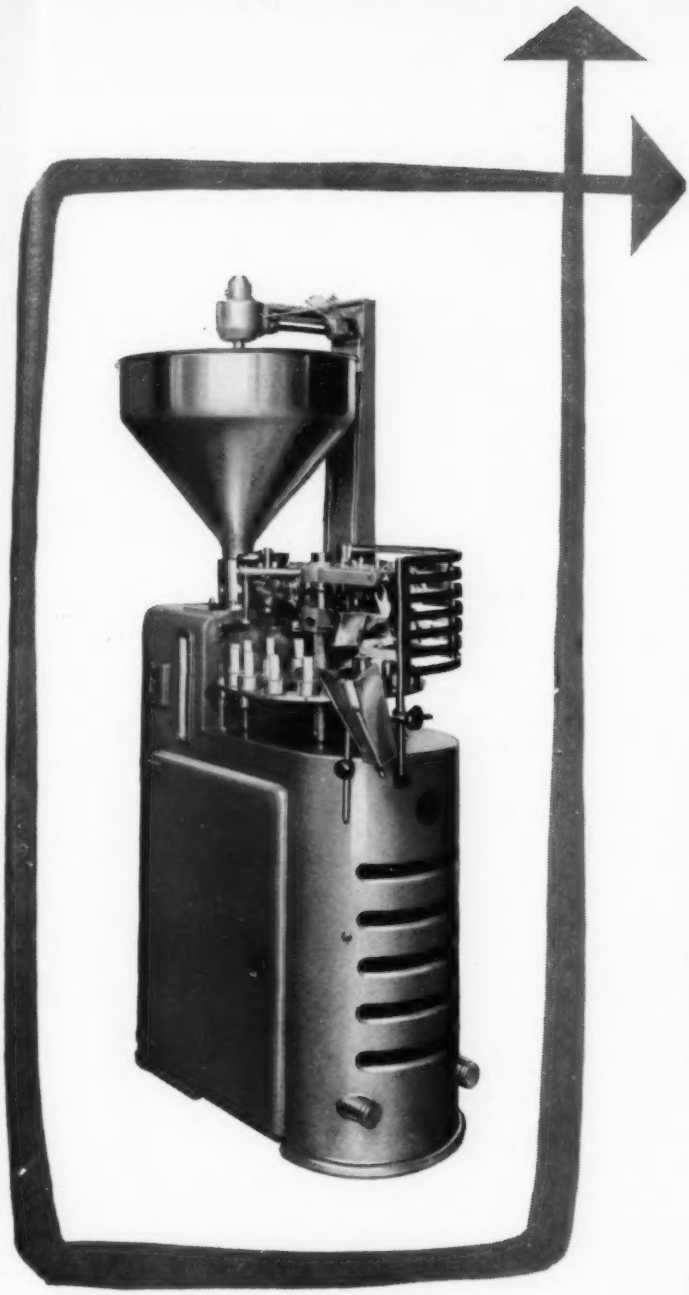

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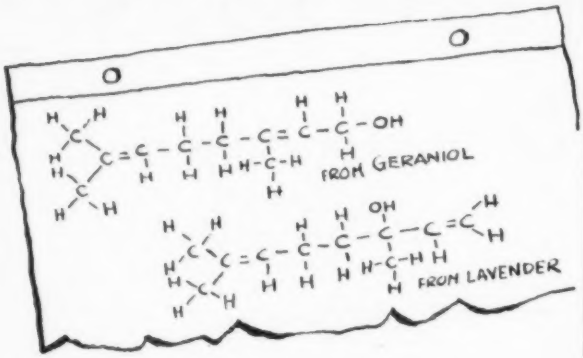


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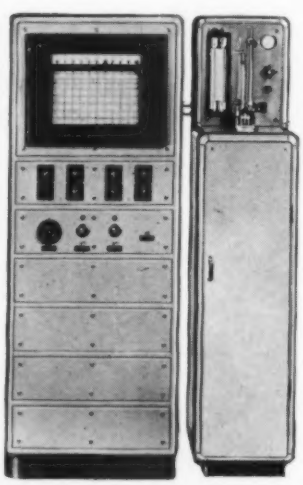

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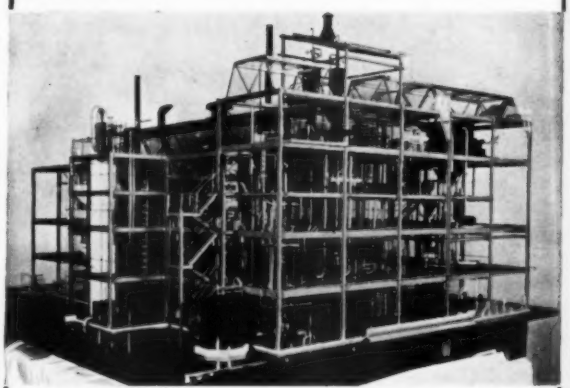

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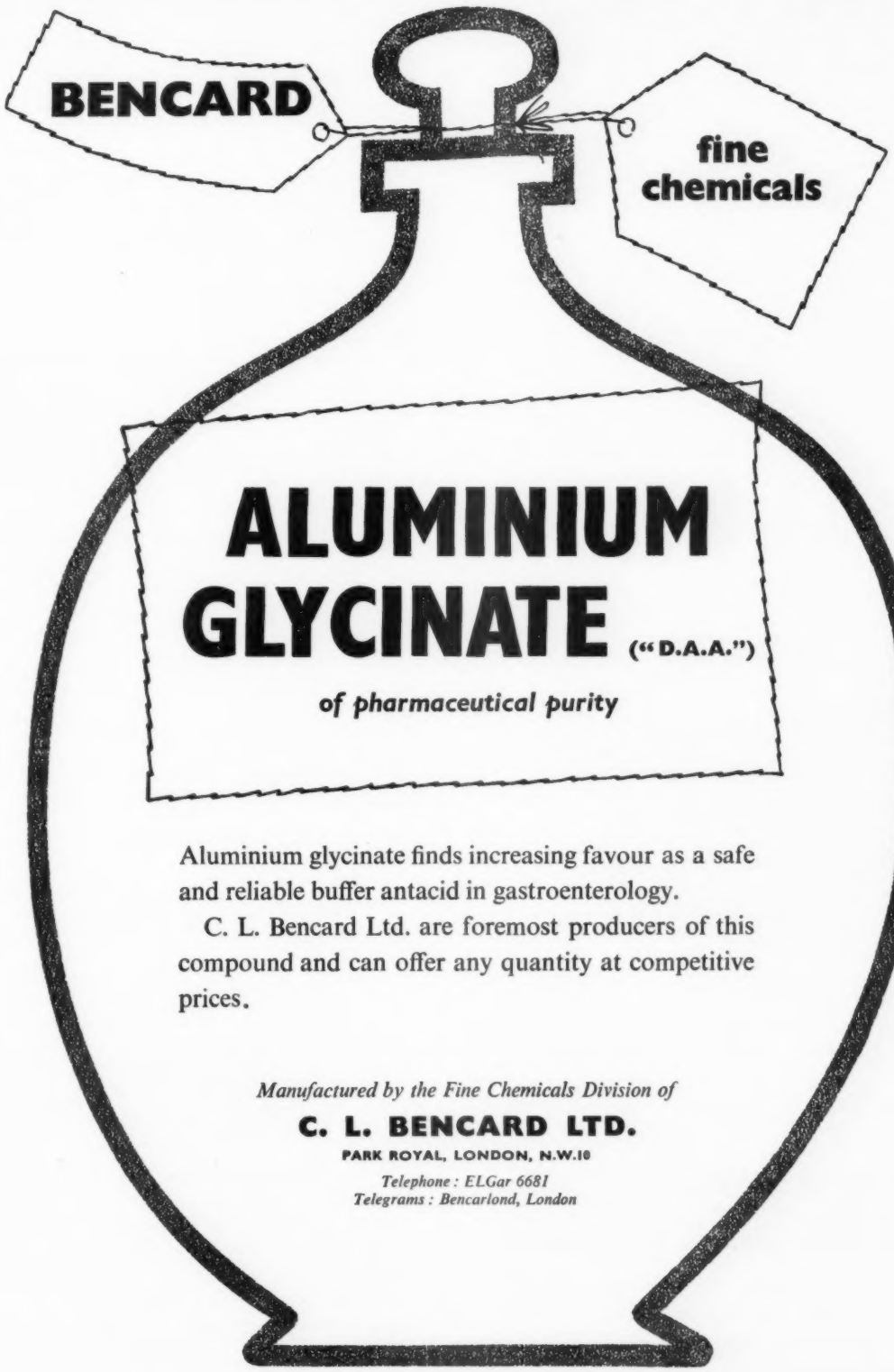


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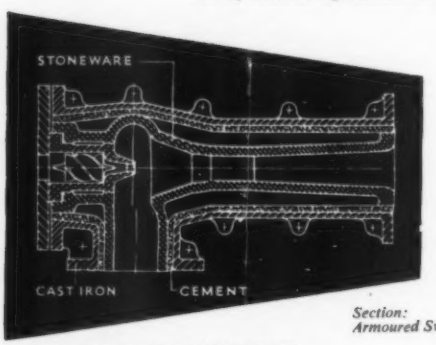


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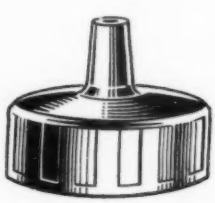

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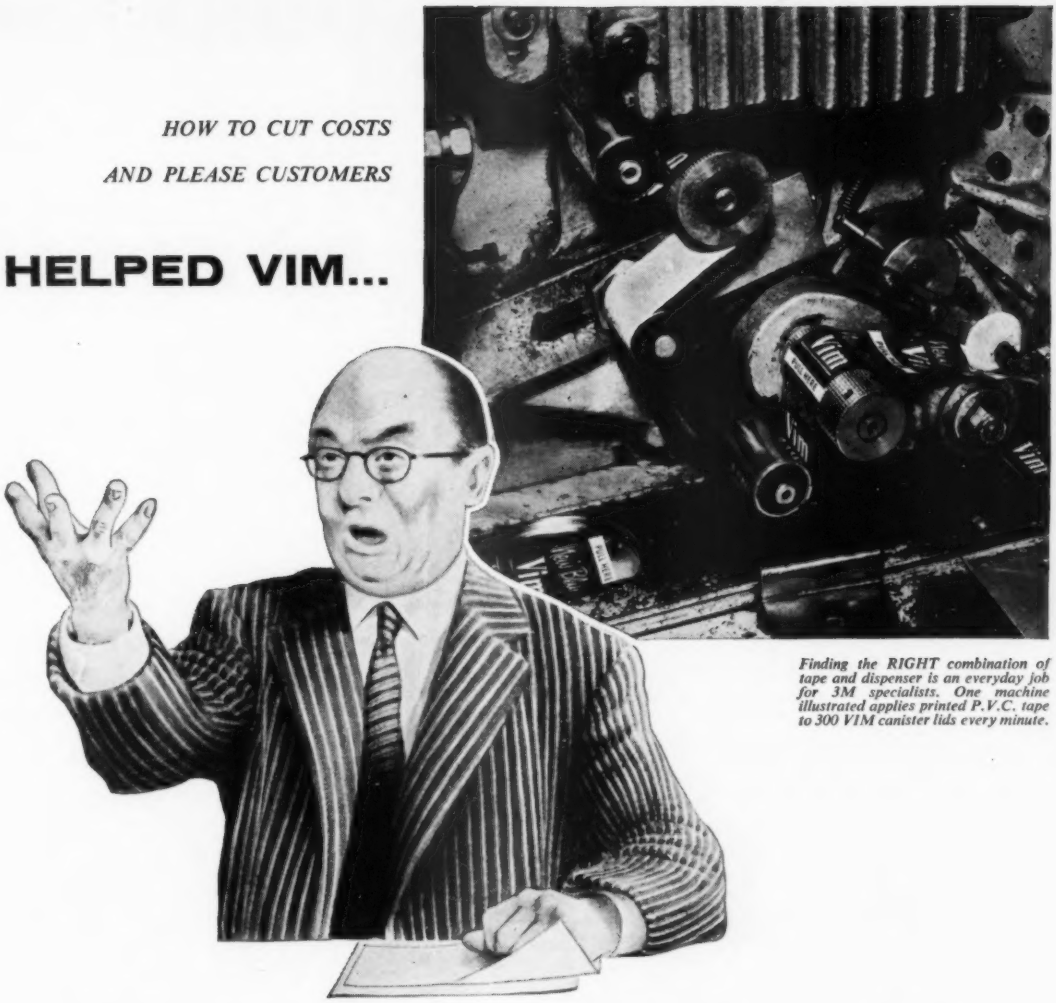

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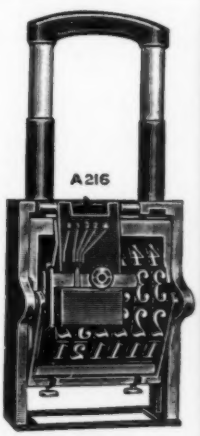


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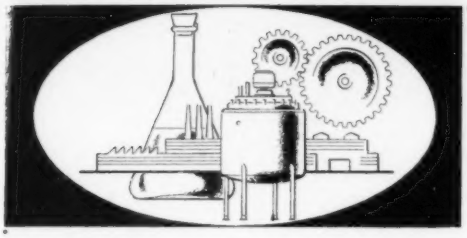

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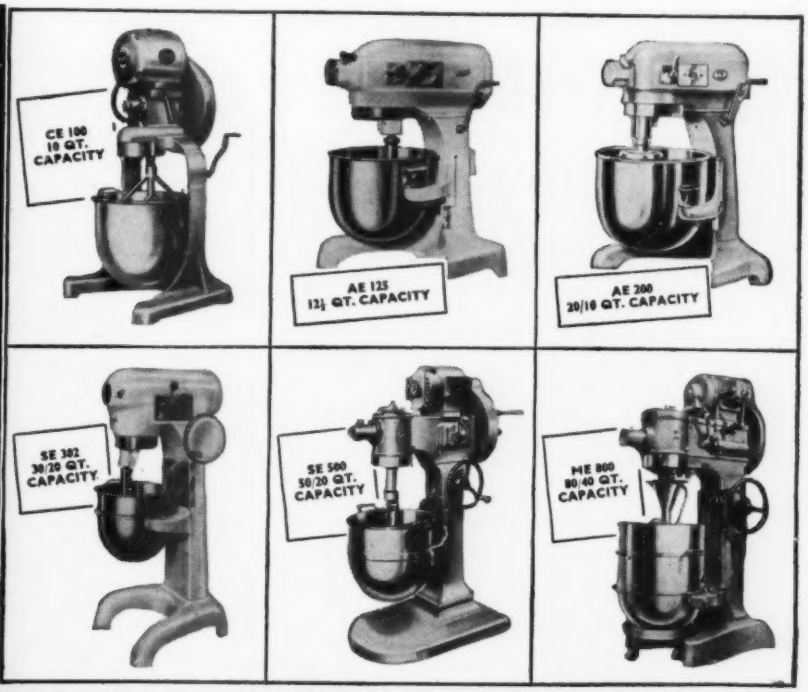


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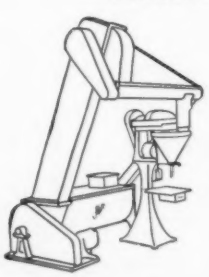

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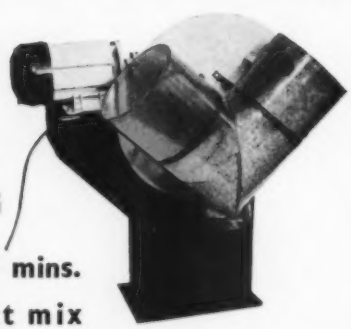

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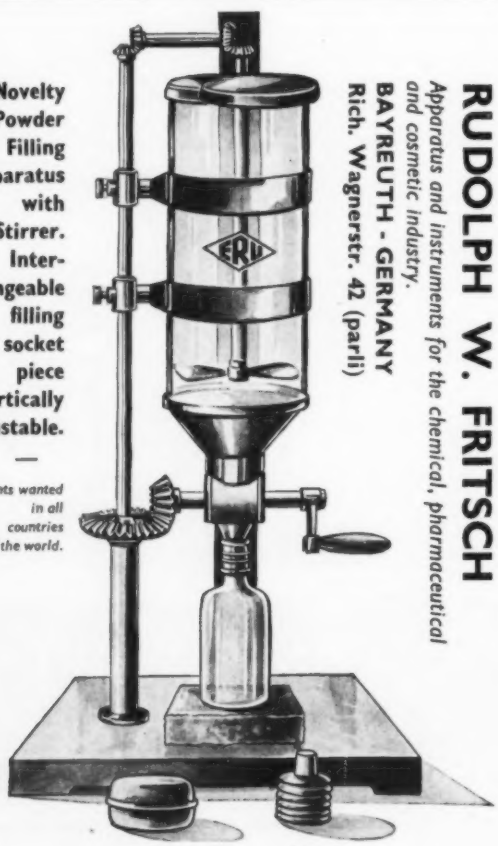

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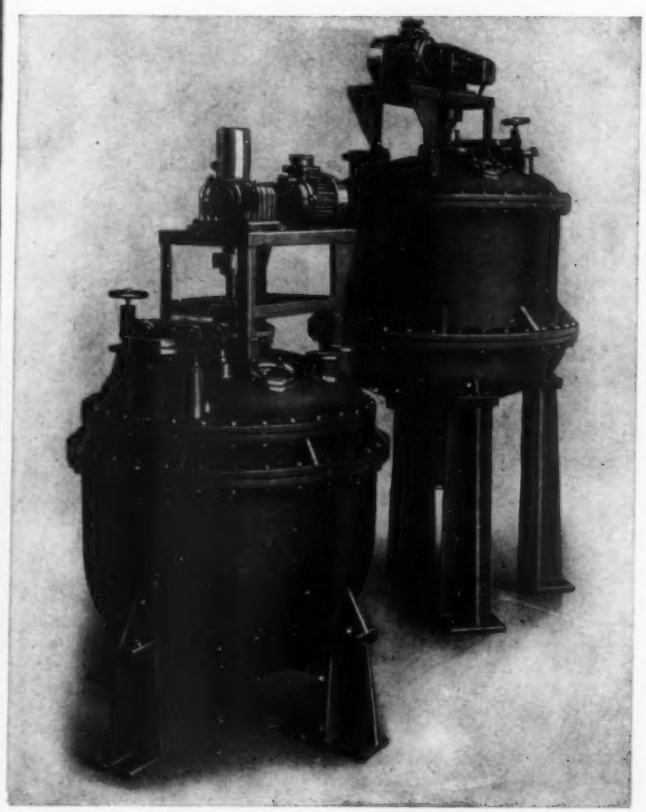

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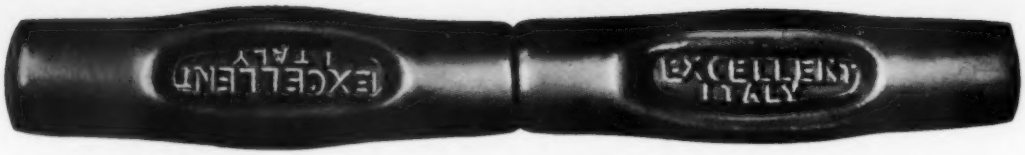


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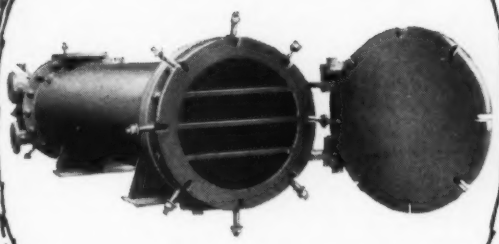

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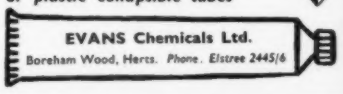


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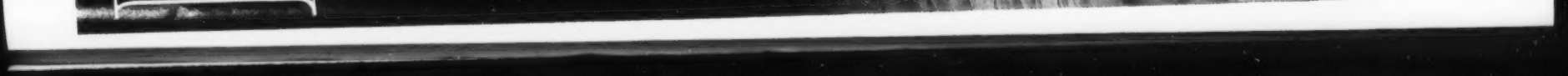

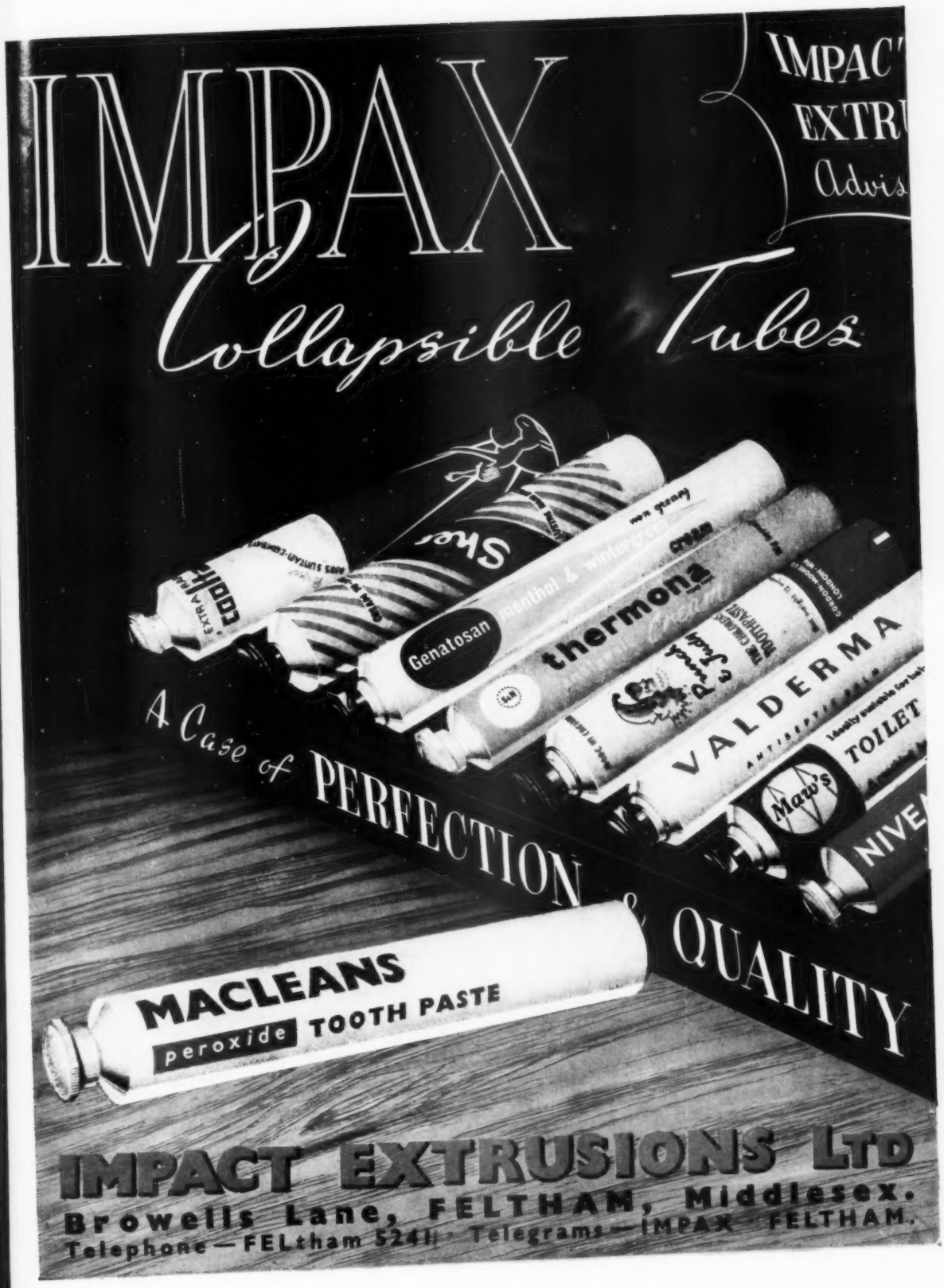
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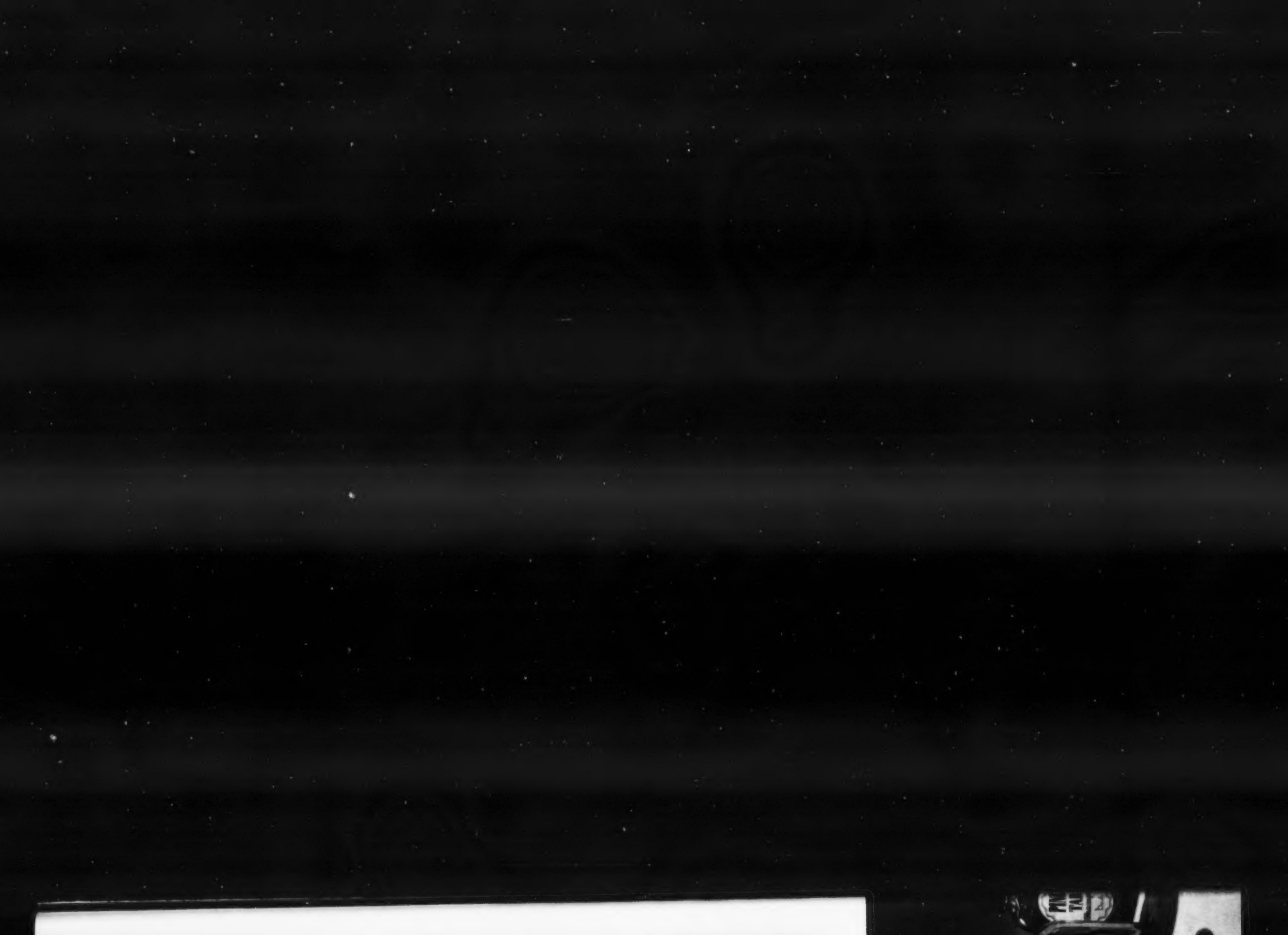
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